THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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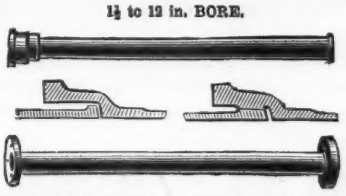

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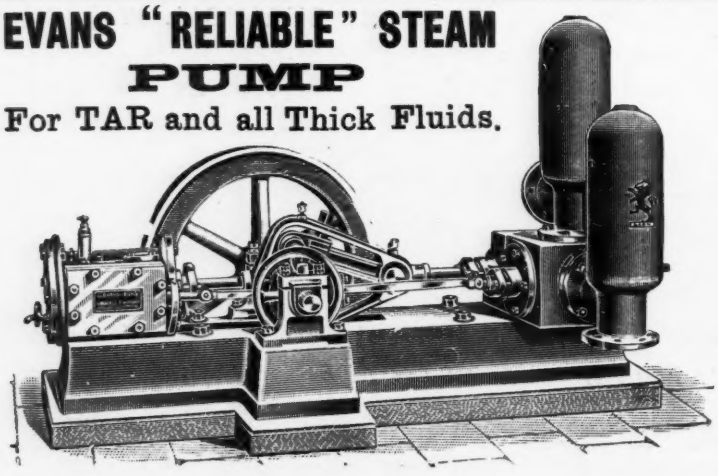

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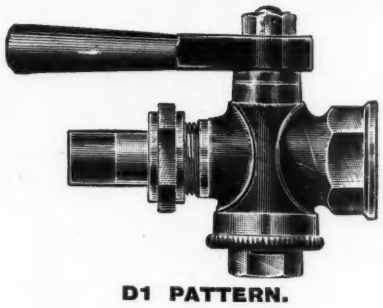

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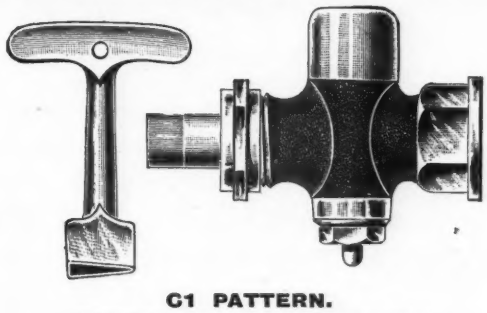

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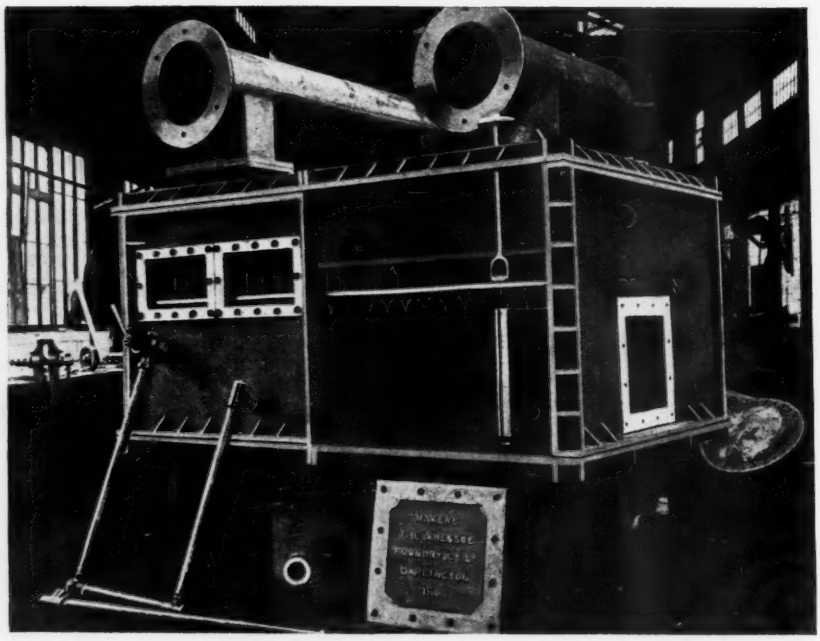

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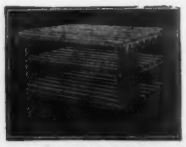
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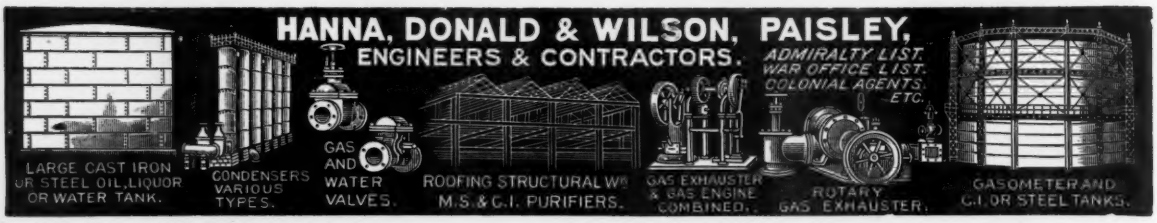
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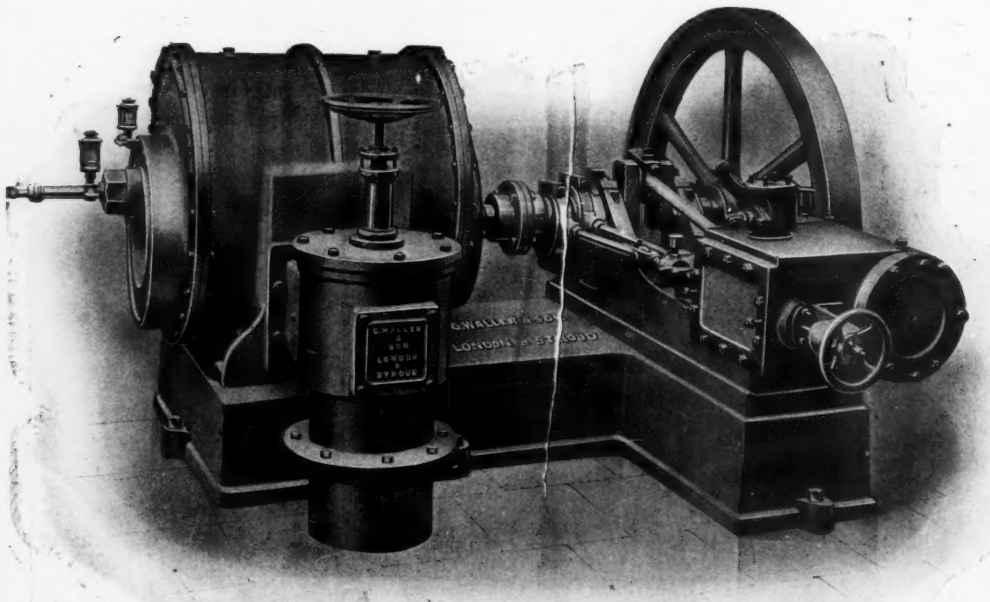

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EDITORIAL NOTES—GAS, &c.

Water Gas and Capital Redemption in Parliament.

COMMITTEE work on Gas Bills in the first session of the new Parliament commenced last week; and there are two or three points in connection therewith to which special attention may be drawn. It is apparent that, with the growth of precedent in the more modern features of gas legislation, local authorities who desire to squeeze something out of the gas companies operating in their areas have, where the concerns have been circumspectly managed, considerable difficulty in finding good and just grounds on which to oppose and to prefer their claims. And it is only by the outside aid of those who glean from session to session hints from all sources, that sufficient demands, can be formulated to make any sort of a case for presentation to a Parliamentary Committee. Local authorities, especially those who are electricity suppliers, appear glad enough, whether or not requests are reasonable, to take advantage of aid of this kind; and this causes the question to frequently cross the mind as to whether ignorance rather than local interests and justice is not at the root of much of the hostility and demand. Take the hotchpotch of requirements presented by the Brighton Corporation and the neighbouring authorities in connection with the Brighton and Hove Gas Company's Bill, in which the proposals were of a character (and so endorsed by the Commons Committee who considered them) designed to inure to the future material benefit of consumers and Company alike—more so to the former than to the latter. The authorities objected to everything—to the new standard burner, to the proposal as to the redemption fund for wiping out ineffective capital, and to the adoption of the special purposes fund; and they unsuccessfully asked for a calorific power test, the restriction of the use of carburetted water gas, and a lowering of the standard price by 3d. The standard burner and the special purposes fund are in consonance with the model clauses and abundant precedent; the redemption fund within limits is an act of wisdom; the demand submitted for a calorific power test, the Corporation could not sustain while the illuminating power test continued; the lowering of the standard price by 3d. was deemed unreasonable, and 1d. was taken off; and the restriction of the use of carburetted water gas was shown by Dr. Haldane to be now less necessary than he at one time thought it to be, and, if such a restriction were imposed, it should be by general legislation and not enforced in the case of individual concerns.

This last matter is of particular interest; and it may be taken that, after Dr. Haldane's evidence, no local authority will again venture to try to uphold the demand made by the Brighton opposition. So long as gas undertakings will voluntarily exercise restraint, as they are now doing, in the matter of the proportion of water gas introduced into the general supply, so long (it may, we think, safely be said) Parliament will not impose any restriction on its use. It is about twelve years now since the Home Office appointed a Committee, of which Dr. Haldane was a member, to inquire into the use of gas containing a large percentage of carbon monoxide; and twelve years after it transpires that, in making their recommendations, the Committee were influenced by the notion that gas undertakings here might follow the example of certain American gas undertakings, and distribute carburetted water gas *per se*. The fear of the Committee in those days, in the light of the explanation now given, was somewhat of a slight upon the discretion of the administrators of gas undertakings; but Dr. Haldane does not hesitate to say now (and we give him full credit for the recognition) that the managements of gas undertakings have themselves in the passing years shown wisdom in this matter, and have largely removed the requirement for restrictive legislation, though he thinks that some credit may be taken for the moral effect of the report of the Home Office Committee. Another matter that he pointed out was that the conditions of the use of gas have in the meantime changed, in that a comparatively small amount of gas is required in (and so a comparatively small amount could, through a tap being accidentally left open, escape into) a room now with the incandescent burner, compared with a dozen years ago when the flat-flame burner was still very commonly used. In addition, the proportion of gas consumed in the day time (when escapes would be readily detected) has been advancing by leaps and bounds. Dr. Haldane was before the Committee last week, at the instance of the opposition, on a Speaker's order; and he completely failed the opponents. In view of the part he took in the report of 1899, it was believed by them that his evidence would be valuable in the matter of the demand for a restriction on the supply of carburetted water gas. After his testimony, the opposition quietly shifted the matter to one side; and later the Committee expressed their view that the subject was not one for them to deal with, but, if dealt with at all, it should be by way of general and not private legislation. The Brighton authorities unwittingly did the gas industry good by their action in this regard.

The question of the provision of a capital redemption fund within prescribed limits was before the Commons Committee in the case of the Brighton Bill and before the Lords Committee in the case of the Bishop's Stortford Bill. There may be many companies with ineffective capital hanging to them, owing to exceptional circumstances, such as the closing down of old works, and the removal to new sites; and it is a good thing for the consumers to get capital of the kind wiped out, instead of allowing it to continue, and so require money year by year for dividend. Sir J. Rankin's Committee who sat in the session of 1899 recommended that efforts should be made by any company having obsolete and unproductive capital to redeem such capital by a sinking fund or otherwise. The Gaslight and Coke Company had a clause put into their Act in 1903, by which provision is made for the extinguishing, by annual appropriations, of a million pounds of unproductive capital. The Brighton Company have some £57,000 of such capital, owing to the closing-down of their old manufacturing stations and the concentration of the plant at Portslade. In the Bishop's Stortford case, the amalgamation of a number of small companies will inevitably result in the closing-down of works; and there will be an amount of capital that will become ineffective. In this case, a line is drawn at capital equivalent to £400 per million cubic feet at which the fund will not further operate. The same thing—though a different figure—was proposed in the Brighton case; but here the Committee preferred to alter the arrangement to the fixed amount of the estimated obsolete capital (£57,000), with the condition attached that the power was not to be taken as a precedent, but merely as an allowance under exceptional circumstances.

There was argument on the part of the opposition that the consumers should not be called upon to provide this fund, but that the obligation should rest upon the shareholders. For industrial undertakings, subject to competition, the dividends of gas companies cannot be said to be extravagant. If the ineffective capital is maintained, consumers have to supply the money with which to pay dividends. By furnishing instead the money with which to liquidate that capital, the consumers are relieving themselves of a perpetual charge, and, under the sliding-scale, will reap the bulk of the benefit that accrues in economy. Mr. William Newbigging fails to see any analogy between what the patrons of a municipal gas undertaking do and what the consumers of gas in a sliding-scale company are asked to do, because he says the former are virtually the owners of the undertaking. Are they? Let us see what are regarded by the local governors—take Manchester as an example—as the gas consumers' obligations, because by comparison one brings into relief

the unfairness that rests upon the municipal gas consumer over and beyond anything that the consumer under a company allowed to redeem to a limited extent unproductive capital has to do. The charges upon the two are alike up to a point. Then present consumers under a local authority are perpetually providing money for the redemption of capital and the payment of interest, and beyond, in all but a few isolated cases, they have to contribute money to hand over to the relief of the rates of a large number of local inhabitants who are not gas consumers, and who have not put their hands into their pockets for the provision of a single penny of capital, as has the gas company shareholder. The company gas consumer asked to extinguish a certain proportion of ineffective capital is in a preferable position. The comparison could be carried further—to the municipally owned electricity undertakings in competition with a gas company. We agree with Mr. Balfour Browne that the clause in the Brighton Bill is "new and important, "and it is justified, not only by the report of Sir James "Rankin's Committee, but by common-sense." It is, in fine, an economic proceeding.

Temperatures Theoretical and Practical.

Highly instructive, though dealing with elementary principles, was the lecture delivered by Dr. Harold G. Colman, to the London and Southern District Junior Association, on Friday night, on "The Development of High Temperatures "by Gaseous Combustion." Both in matter and in the illustrative demonstration, the lecture was particularly appropriate for what is to all intents and purposes one of the educational bodies for the juniors of the gas industry. The lecture, of course, was largely theoretical; but for next session the members are promised the complementary part which will treat of two of the practical applications of gaseous heating—the heating of retort-settings, and the heating of incandescent mantles. The only criticism of the lecture that there is to be made does not relate to commonly accepted matter and facts, but to style. We cannot, however we look at Dr. Colman's submission, see why it was "much "more convenient" for this lecture to use the metrical system unit of heat than the British thermal unit. The only convenience that can be imagined was in the saving of the time that would have been expended in conversion from one to the other in the preparation of the lecture. In an Association the bulk of the members of which are learners in the technical affairs of the industry, it would have simplified matters (true, not for the lecturer, but for the members' appreciation) to have had figures in terms of their native measure rather than in those of the metrical system. The calorie is all right for the laboratory, as it is in harmony with the apparatus, but for the practical man the British thermal unit is preferable for more than one reason. The point need not be laboured; but the argument advanced in the article entitled "Official Calorimetry of Gas" in the "Journal" for Nov. 9 last (p. 378) will apply. This is the only criticism.

But that apart, the members of the Association, from the clear locution of Dr. Colman, which reduces the (to some) abstruse to perfect transparency, know more than they did before regarding the theory of high temperature development by gaseous combustion; and with the additional knowledge, they must already better appreciate the practical applications, and will do so still more when they have again been privileged to hear Dr. Colman. There is no more interesting field for diversified research and study than this one of heat. The chemical actions and interactions that proceed in combustion, the ideal conditions to the attainment of the highest possible temperatures, and cognate matters, lead into all sorts of instructive and interesting byways of the subject that are contributory to the theoretical side. Then between temperatures that are theoretically possible and temperatures that are obtained in practice, there is a considerable difference from which the student and the inventor is ever trying to make recovery to place to the credit of utility. This is where the practical man comes in; and he is the better able to usefully work in this field if he is the master of the knowledge framed succinctly but strikingly by Dr. Colman in his first lecture. There are heat losses that cannot possibly be avoided; but the history of invention shows us some remarkable materialized ideas in different lines that have yielded heat efficiencies far transcending anything that had previously been accomplished. In the gas industry we depend now for our very existence almost entirely upon the temperature efficiencies that can be obtained by the appliances produced for utilizing gas. Such appliances are vital to our future; and the greater the improvement that can be realized in their effective performance, the better. Good as they are now, there is plenty of room for producing still greater temperature efficiencies; and such lectures as that of Dr. Colman will pave the way to effort by men who have possibly not hitherto given much thought to the matter. Juniors require lectures that are not only instructive, but inspiring; and this is one.

To the Memory of a Worker.

Ever feeling that in the life of Mr. William Young there was never any sufficient recognition by the gas industry of the work that was rendered by him to it through his scientific research and the productions through his pen of a naturally powerful and highly-cultured brain, we are glad to learn that the first steps have been taken to create a suitable memorial. The Committee of the North British Association of Gas Managers, who have had the matter in hand, have evolved a plan by which the work of this learned friend of the industry will be kept green in memory, and serve as a stimulus hereafter to those who will occupy technical positions in the industry, but will not have been contemporaries of Mr. Young, and so will not have had the advantage of being brought into direct contact with his fine nature, and of imbibing direct from the great intellectual fount which was kept running to the very end. It is fitting that the North British Association should take up this matter, and that the duty of prosecuting and administering the memorizing scheme should be vested in that body. Mr. Young was a distinguished member of the Association, contributed largely to the proceedings, and his work (over which hovered the one ambition to aid in the world's economic progress) was conducted almost exclusively in the territory from which the members of the Association are drawn. Though there is this especial geographical interest, the fruits of Mr. Young's work, and the honour attaching to his name, know no bounds. The Memorial Committee have determined upon the establishment of a lectureship; and such lectureships cannot be founded without money. We appeal, therefore, not only to the gas administrations, engineers, and managers in Scotland, but to their industrial and professional compeers throughout the British Isles, to let the necessary fund be accumulated without delay, and not be made up in that tardy manner that has become almost a characteristic of, and reproach to, the gas industry. For a biennial lecture, the capital sum required is not large. It is considered that £600 will suffice; a larger sum would, of course, give the administrators of the fund more freedom, as naturally they will only have the proceeds of the invested fund with which to deal. The lectures will treat of the chemistry, manufacture, distribution, and application of gas; so that the primary object of the establishment of the fund will be accompanied by a secondary and very practical one. In its useful scope, the form the memorial is to take is in pure consonance with the life, spirit, and activities of the man whose memory it is desired to honour. From near and far, we hope that the Hon. Secretary and Treasurer to the fund—Mr. Alex. Bell, of Peebles—will receive generous and quick response to his appeal for contributions; so generous and quick, in fact, that the memory of the establishment of the fund will be one of its pleasant associations. Further information appears in another part of this issue.

The Farmer and the Fertilizer.

With a word of congratulation to the Sheffield Gas Company upon the results of last half-year's trading—which produced, with gas at an average price of 1s. 3·04d., an increase of 6·35 per cent. in consumption, and enabled the Directors to show that the last reduction in price had been recouped in profit—there is one point in the remarks of the Chairman (Mr. Wilson Mappin), at the meeting of the shareholders a few days since, to which special attention may be called. In this statistical age, so many figures come before one that it is not always that the full relative significance of certain of them is observed. Mr. Mappin brings to the surface an instance; and it must be confessed that what he has introduced to notice is somewhat surprising. It is that of an estimated production of 348,000 tons of sulphate of ammonia in the United Kingdom in 1909, no less than 264,000 tons were exported. These figures were

known before; but the result of subtraction had not been completely appreciated. Taking the smaller figure from the larger, it is seen that the difference is 84,000 tons, which shows that only about 24 per cent. of the total estimated home production is used by our own farmers, while 76 per cent. is exported. It is no doubt a good thing to have a substantial export trade, and to maintain it. But the comparative figures do not look at all well for home use; and there must be a much larger field here for sulphate of ammonia absorption. The trouble, however, is to get hold of the field.

The Sulphate of Ammonia Committee have not by any means been lax in prosecuting educational work among farmers; and their propaganda efforts are being enlarged. And not only so, but they are endeavouring (according to Mr. Hanbury Thomas, Managing-Director of the Sheffield Company, and a member of the Committee) to persuade the Board of Agriculture to encourage the experimental use of sulphate of ammonia by the agricultural colleges working in conjunction with the Board. It is a mysterious thing that in this country the gas industry should always be so loth to spend money on matters pertaining to its common interests; it is also strange that the Government of the country does so little to encourage and assist home industries in developing trade and commerce. And it is somewhat humiliating that we should so often be directed to go abroad for copies worth imitating in the matter of rational conduct in regard to industrial and educational questions. In this matter of sulphate of ammonia, we have Mr. Mappin telling us that in Germany the Government lends assistance in this direction to manufacturers, with the result that whereas in 1896 the quantity of sulphate of ammonia used by the German farmers was 80,000 tons, nearly four times the quantity—284,000 tons—was consumed in 1908. That is to say, fourteen years ago Germany was consuming nearly as much sulphate of ammonia as is used in the British Isles in 1910; and that country's home consumption in 1908 equalled rather more than 82 per cent. of our total production in 1909. Japan is fully alive to the value of sulphate of ammonia as a fertilizer, as is seen by the rapid increase in their imports during the last eight or nine years. The work to which there has to be steadfast attention is that of educating the farmer, while there must not be a decline of perseverance respecting the export trade, for which there is keen competition. In the former matter, Chairmen of Gas Companies might do much good, and certainly no harm, in making a point of calling attention to the subject of the utility of sulphate of ammonia as a fertilizer at the reported meetings of shareholders, in the manner that Mr. Mappin has done. With production increasing, there must be advertising on all suitable occasions, in addition to educational work; and meetings of gas companies are such occasions.

Income-Tax Allowance for Depreciation.

Our readers may remember that an appeal on behalf of the Whitchurch and District (Hants) Gas Company, Limited, for an allowance in respect of depreciation for decreased value of plant and machinery by reason of wear and tear was heard by the District Commissioners sitting at Whitchurch on the 12th of November last. An assessment had been made allowing for depreciation; and this had been subsequently amended by withdrawing the allowance. Mr. W. A. Schultz appeared on behalf of the Company, and argued the case on the question of principle; and, in view of the importance attaching to their decision, the Commissioners decided to adjourn the consideration of the question. It was further argued by Mr. Schultz last week; and a report will be found elsewhere. It will be seen therefrom that the Commissioners decided that depreciation should be allowed to the extent of 3 per cent. on the value of the plant and machinery as written down—being on the same basis as last year. It may be pointed out, in connection with this decision, that the claim for compensation must be made when the income-tax return is sent in.

Investment of Renewal Funds.

Though specially applicable to the Worthing Gas Company, the judgment given last week by Mr. Justice Swinfen Eady, as reported elsewhere, in an action brought against them by a shareholder to obtain a declaration as to the investment of the renewal fund formed under their Act of 1907, is of interest to other companies. The Company had, in three succeeding half years, set aside certain amounts to form the fund; and by so doing had complied with the Act. But, instead of investing the money, they had used it for extensions; considering this was preferable, in the condition of their capital account, to borrowing money or issuing further capital for the purpose, paying high interest upon it, and investing their fund at a low return. Mr. William Cash, one of the Directors, clearly explained the position to his Lordship, who quite appreciated witness's points and the good intentions of the Board in the course they took. But there were the express words of the Act. He thought the plaintiff was justified in bringing the action; and he made the declaration asked for, but worded it so that the invested fund can be drawn upon when wanted for the purposes contemplated in the section sanctioning its formation.

London Port Dues and Coal.

It will be remembered that, in the editorial reference to this matter last week, it was stated that, on the representation of the London and other gas companies, and interests concerned in coal in other ways, Lord St. Aldwyn (who has been inquiring, on behalf of the Board of Trade, into the schedule of rates provisionally proposed by the Port of London Authority) had concluded that 6d. per ton maximum was too high. He also laid down the principle that, in respect of such a necessary as coal, the maximum rate and the actual should have a fairly close correspondence. The Port of London Authority has apparently taken the hint of his Lordship; and, as will be seen from a report in another part of this issue, they have come to terms with the objectors—the Gas Companies reserving the right to raise the matter again should the Board of Trade make any ultimate alteration in the rates to their prejudice. It is understood that the maximum for coastwise and oversea coal that will appear in Lord St. Aldwyn's report will be 2d. per ton; and coke will be treated *pari passu* with coal. That is more reasonable.

The Burden of Compensation.

The scope of workmen's compensation has so continually been widened, that employers may possibly by this time have attained a frame of mind which will enable them to regard with fortitude the latest decision of the House of Lords, upholding judgments of the Courts below, though only by a majority of three to two. The question to be decided was an eminently straightforward one—namely, whether a man, suffering from an aneurism in so advanced a state of disease that it might have burst at any time, who was tightening a nut with a spanner when the strain (quite a usual one in the ordinary course of his work) ruptured the aneurism and so led to his death, died from an accident, so as to entitle his representatives to compensation under the Act of 1906. The Lord Chancellor, in agreeing that he did so die, remarked that an accident had been defined by the House of Lords as "an unlooked-for mishap or an untoward event which is not expected or designed." Next, the accident must be one "arising out of" the employment. There must be some relation of cause and effect between the employment and the accident, as well as between the accident and the injury. He thought some of the difficulties in applying the Act were due to this. It, however, seemed to him sufficient if it appeared that the employment was one of the contributing causes without which the accident which actually occurred would not have happened, and if the accident was one of the contributing causes without which the injury that actually followed would not have followed. The breaking of the aneurism was certainly an "untoward event." It was not designed; and it was unexpected, in the sense that a man who knew the nature of the work would not have expected it. The crucial point was whether the accident was one "arising out of" the employment; and, on this head, he was of opinion that an accident "arose out of" the employment when the required exertion producing the accident was too great for the man undertaking the work, whatever the degree of exertion or the condition of health. It should here be noted, however, that the Lord Chancellor was careful, in connection with his judgment, to point out that it did not mean that everyone whose disease killed him while he was at work would be entitled to compensation. In each case the arbitrator ought to consider whether death came from the disease alone or from the disease and employment taken together. He confessed that in the present instance, if he had

been the arbitrator, he might have come to a different conclusion on the facts; but as it was, he was, of course, bound by the finding, if there was evidence to support it. Lord Shaw, who dissented, thought it was impossible to attribute the man's death to injury by accident; and if it were so attributed, it would involve a liability which was not imposed either by the language or in the intention of the Statute. His concluding words show—what has often been pointed out before—how liable are Acts of this character to "cut both ways." He said that, if such a case were regarded as an accident, "a new peril will have been introduced into the lives of many workers who, notwithstanding debility and chronic disease, are most anxious and willing to devote their remaining powers to earning an independent livelihood. Should such persons be held to carry with them into employment the serious additional liability alluded to, employment may become for such persons (often the most needy and deserving of the population) more difficult to obtain."

The Explosion at the Geneva Gas-Works.

The additional particulars which, by the courtesy of M. Des Gouttes, the Gas Engineer to the Municipality of Geneva, we are able to give to-day in regard to the lamentable explosion which occurred in the gas-works of the city on the 23rd of August last, furnish probably all the information we are now likely to get as to the cause of the accident. There are two features of special interest in connection with the account which appears elsewhere—viz., the discovery of what may be called the primary cause of the explosion, and the plan and sections sent by M. Des Gouttes of the building in which it occurred and the portion of the plant concerned in it. The circumstances which led to the catastrophe may be explained in a few words. A portion of a new 32-inch main had been laid under the station-meter house, and a governor of similar dimensions was fixed in connection with it; the new main being joined near its two ends (both plugged) to an existing 20-inch main. The new governor was put under test at the close of the week preceding the accident; and everything was satisfactory. The following Monday the plug was removed from the town end of the main, and when this was done the presence of gas was detected by the two men engaged on the work. But it appears they were told by the foreman that it was only the gas left in the pipes after the tests the previous week. "What occurred after this," to quote the words of our account, "nobody knows for certain, because all the witnesses of the accident, and probably those who caused it, are dead." Its effects, however, are only too apparent from the views we now give and those which have already appeared in the "JOURNAL."

Its Cause and its Lesson.

We now come to the cause of the accident, which was discovered when the wreckage produced by the explosion had been cleared away. The valve on a connection between the new main and the old one (which was in use) was found fully open, though it was supposed to have been left safely closed on the conclusion of the tests. How it came to be open nobody knows, and never will know. This is certain: A key was necessary to move it, and 62 turns were required to bring it into the condition in which it was found. It can only be surmised that one of the two workmen must have gone to the valve, and, under the impression that he was gradually closing it, released it from its condition of security, and with every turn of the key enabled it to liberate a greater quantity of gas to form with the atmosphere an explosive mixture potent for mischief. It is needless to speculate as to how this mixture became ignited; the speculation should be rather as to how its production could be brought about by the action of a possibly absent-minded workman. Surely there must have been some indication, by means of arrows, of the direction in which the lever operating the valve should be turned for opening or closing it. If so, then the act must have been performed in a condition of mental aberration similar to that which prompts a railway signalman to pull a wrong switch and send a train to its destruction. In the case of the great explosion near Tottenham Court Road thirty years ago, which caused the deaths of two men, though the verdict of the Jury at the inquest was that the accident was due to a defect in the valve at the junction of two mains, the Coroner questioned whether the evidence went so far as to justify it; for he pointed out that the valve might have been opened by misadventure. In the absence of evidence of wilfulness or ill-feeling—for there does not appear to have been any labour trouble on the works at the time—this must be the conclusion in the present case. But if such feeling did exist, or even if there was any negligence on the part of those whose duty it was to keep a watchful eye over the workmen, a heavy penalty has been paid for it. While this terrible disaster naturally evokes the sympathy of all gas engineers and managers with the Geneva Municipality, their chief gas official, and all who have suffered, personally or pecuniarily, in consequence of it, it at the same time serves to impress upon them more forcibly the necessity for the exercise of the utmost vigilance to prevent the occurrence of an accident even remotely similar in the works which are under their own supervision.

Trading in Coalite.

The British Coalite Company have not many carbonizing centres yet; and those that they have are not of any great magnitude, having regard to the fact that the Company aspire to become universal fuel providers. The plant at the Hythe Gas-Works is probably the smallest one; but apparently the Company cannot dispose of the whole of the coalite produced in the large area close at home, including Folkestone. They have opened a store at Canterbury, to which local orders have to be addessed, while it is requested that all other inquiries be sent to the Coalite Company at the Hythe Gas-Works. In advertising this fresh effort to secure extended business for coalite, the British Coalite Company quote "14s. for ten large sacks," with "6d. discount for cash on delivery;" and it is added "this quantity is equal *in bulk* to one ton of coal." That is a disingenuous way of putting the matter to the general public. The public usually recognizes a sack of coal as containing 2 cwt.; and as ten large sacks are quoted here, and is stated to be equal "in bulk" to a ton of coal, the public may be easily misled into thinking that a ton of fuel is to be obtained for 14s. There is no guarantee as to what these ten large sacks contain; nor whether one sack may be depended upon to be equal to another. But this we do know, that 1 ton of coalite occupies as much space as 2 tons of coal; so that we arrive at the fact that a ton of coalite costs at the present time 28s., less 1s. discount for cash on delivery. This is rather a steep price for fuel from which gas and other combustible material has been removed; and which, according to an article in the "Chemical Trade Journal" a few months ago, results in coalite being (so it is said) useless for ordinary kitchen ranges, as there is no flame to pass round the oven. A further effect of this is that food is asserted to become tough through the longer time required in baking. From the domestic point of view, an additional drawback is that 1 ton of coalite requires for storage the same space as 2 tons of coal, which limits by one-half the fuel a householder can stock prior to winter.

The Serious Work of the Juniors.

Again this week, a considerable portion of our space is occupied with the chronicling of the doings of the Junior Gas Associations. In fact, during the winter months generally these organizations have become a prolific source of "copy" for the pages of the "JOURNAL"—too prolific at times, it must be confessed, to be altogether convenient. But inconvenience, when it has arisen, has been borne with, in the belief that the Junior Associations are doing a good work, in which it is to the interest of the industry at large that they should be in every way encouraged. This remark, of course, applies to the movement in the abstract. Taking the meetings individually, it is found that many of the papers and discussions are quite in the front rank; and the profession as a whole is a gainer by their publication. It is, however, principally the benefit in the first instance to the members themselves that we have in mind in penning this note. The frequency of the meetings of the different Associations in the winter months calls for a substantial sacrifice of leisure time on the part of some of the members, and of working time on the part of many others. Their leisure is cheerfully devoted to the cause by those of whom it is demanded; and it is a gratifying, as well as highly significant, feature of the movement that, where necessary, leave of absence is so freely granted by their chiefs during working hours, to enable assistants to attend the meetings and visits to works—a fact which is appreciated the more, when it is remembered that the absence of an assistant may possibly mean that his chief has to remain at the works when otherwise he would be off duty. Occasionally, some managers—possibly through not

having time to carefully study the published reports in the "JOURNAL" of the meetings of the juniors—may have felt inclined to ask themselves whether it was worth while to afford so many facilities to their assistants to attend the meetings. That is to say, whether the members were likely thereby to become more efficient servants to the undertakings they serve. If there are any still desiring to be assured on this point, we would suggest a visit to a meeting or works inspection of one of the organizations. It would then be seen that the members take their Association work really seriously. Whether it be at the reading of a paper or a visit to a works, one cannot but be impressed by the wide desire displayed to obtain information. On a recent occasion, an assistant from Croydon stated that when he was leaving for a meeting, Mr. J. W. Helps said to him: "Mind you learn something." These words sum up the situation perfectly. The Junior Association forms an excellent medium for acquiring useful knowledge; and the members are bent on taking the fullest possible advantage of it. This expression of opinion, to take a particular instance, will, we feel sure, be fully acquiesced in by the number of seniors of the profession who were present on Friday night last when Dr. Harold G. Colman delivered the first of two lectures to the members of the London and Southern District Junior Gas Association—as well as by the many engineers who have at different times kindly invited the members to inspect their works. So long as the Junior Associations continue on present lines, they will not lack the support of those who are in a position to assist them.

More Strike Fears in South Wales.

After a further period of uncertainty, the news was received yesterday morning of the failure of the Coal Conciliation Board for South Wales to arrive at a satisfactory arrangement with regard to the matters that have now been so long outstanding between masters and men. Negotiations between the representatives of the parties have been broken off; and the country is faced with the danger of a stoppage of production in this important coalfield on the termination of the agreement at the end of this month. The state of affairs thus set forth is one that has been met with before—and at the last moment wiser counsels have prevailed. This reflection will probably induce most people to confidently look forward to a similarly happy issue out of the present trouble. But it is impossible to overlook the fact that this continual straining at the bond of "conciliation" is a risky operation, which may be indulged in once too often. The owners, it seems, are adopting a determined attitude, the basis of which is that they must have relief for the increased cost of coal production imposed upon the industry by the operation of the Mines Eight-Hours Act—that measure of which everyone is by this time heartily sick. According to the Labour Correspondent of the "Financial Times," the owners put this increased cost down at no less than 1s. 7d. per ton—a figure which goes far to justify the opinions expressed, long before the measure became law, by many of those well qualified to judge. Of course, there are a number of questions at issue; but these it is unnecessary to go more closely into now, as they all bear more or less directly on the increased cost of getting coal under the new conditions. The situation briefly is that no arrangements have been made for any further meeting of the Conciliation Board, but that the owners have expressed their willingness to meet the workmen's representatives, if the latter have any further proposals to make.

Experiments have recently been made at the Bureau of Standards at Washington to determine the proper source of light to combine with the mercury arc to produce the best imitation of average daylight; and the results were embodied in a paper by Mr. H. E. Ives in the number of the Bulletin for November last. According to an abstract in "Nature," the ordinary lights, the Welsbach mantle, the carbon, the tungsten, and the tantalum filament glow lamps are nearly complementary in colour to the mercury lamp, and have, therefore, only to be combined with the latter in suitable proportions to produce satisfactory imitations of daylight. The best proportions are 1-candle power of mercury light to 0·57 of Welsbach light, 0·54 of tungsten, or 0·50 of carbon glow light. The watts per candle power required are 0·8 for the tungsten and 1·4 for the carbon filament combinations respectively. Though the Welsbach mantle cannot be compared in this way, the author finds from the cost of running that the Welsbach-mercury combination compares closely with the tungsten-mercury one in efficiency.

OBITUARY.

SIR FREDERICK THORPE MAPPIN, BART.

We regret to record the death last Saturday, at his residence, Thornbury, Sheffield, within about two months of completing his eighty-ninth year, of Sir Frederick Thorpe Mappin, whose name is well known to our readers from the position he so long held as Chairman of the Sheffield United Gas Company. He had been in failing health for some time; but a few weeks ago a slight operation was found to be necessary for throat trouble, and to this he succumbed.

Sir Frederick Mappin was the eldest son of the late Mr. Joseph Mappin, a well-known manufacturer of cutlery in his day; and at the early age of fourteen he left school in order to assist in his father's business. Six years later the death of his parent threw upon him—a young man of twenty—the entire responsibility for the management of the concern. He subsequently took his younger brothers into partnership; but in 1859 he left the business to become senior partner in the still existing firm of Messrs. Thomas Turton and Sons, steel manufacturers, of the Sheaf Works, Sheffield. He entered the Town Council in 1854; and was elected Master Cutler the following year. He filled the office of Mayor in 1877-8, and shortly afterwards his municipal career closed. At the General Election in 1880, he was chosen, with Mr. F. J. S. Foljambe, to represent the borough of East Retford. After the Redistribution Act, in 1885, he stood for the Hallamshire Division, and represented this constituency until his retirement from public life in 1905. In 1886, a baronetcy was conferred upon him—an honour which was on all sides considered to be well deserved as a fitting recognition of the important part he had taken in political affairs, and especially in the municipal and commercial life of his native town.

His connection with the Sheffield Gas Company was of long standing. He must have had a keen recollection—there are but few left who possess it—of the troubles arising from the Flintoff-Croll agitation in 1854, when "twenty thousand Sheffield men" publicly expressed their determination to put an end to what was stigmatized as the gas "monopoly," or "know the reason why." The competition between the Sheffield Consumers' and the Sheffield United Gas Companies ended, as in many other cases of the kind, in the amalgamation of the two bodies. The result was that Sheffield was burdened with an additional £50,000 of dividend-bearing gas capital, and the consumers had to pay 4s. per 1000 cubic feet for their gas, instead of 3s. as promised by the promoters of the new Company. The joint concern then entered smoother waters, and after about eight years—viz., in 1862—Sir Frederick (then Mr.) Mappin was elected a Director, and gave the Company the benefit of his wide business experience. In 1873, he was elected Chairman, in succession to Mr. Lockwood, and occupied this position without interruption, with honour to himself and prosperity to the Company, till his retirement, on account of failing health, on Aug. 31, 1908, when he was followed by his second son, Mr. Wilson Mappin. He, however, retained his seat on the Board, and continued to take an interest in the affairs of the Company with the progress of which his life had been so closely identified. He had had the gratification of seeing the price of gas so reduced—in spite of so-called "monopoly"—as to become conspicuous among the lowest in the United Kingdom; and it was by a sad coincidence the last half-yearly meeting of the Company, at which full dividends were declared, and the severance by death of his connection with it, should have taken place within one week, and call for notice in the same issue of the "JOURNAL," to the columns of which the deceased had often expressed himself indebted for information on the current affairs of the gas industry.

Sympathetic references were made at the Police Court on Saturday, and at various places of worship next day, to Sir Frederick's death, and high tributes were paid to his noble character. Preaching at St. Silas Church, the Bishop of Sheffield told the congregation that if they looked through Sir Frederick's work they found that he was "not content with materialism or imperialism or any other 'ism;' but everything philanthropic or educational or religious that affected the upward welfare of the body, mind, or spirit of the people of Sheffield had his generous and sympathetic support."

The deceased baronet married in 1846, and on Sept. 25, 1906, the sixtieth anniversary of the wedding was celebrated very quietly at Thornbury. Lady Mappin died about two years ago. He leaves three sons—Mr. Frank Mappin and Mr. Wilson Mappin, who are associated in the management of the Sheaf Works; and Mr. Samuel Mappin, who devotes himself to agriculture. The first-named gentleman succeeds to the baronetcy. The interment takes place to-morrow (Wednesday) in Eccleshall Churchyard.

Mr. H. JAMES YATES (Messrs. John Wright and Co.) has been elected a Member of the Institution of Mechanical Engineers.

Mr. WALTER C. SCOTT, Gas Manager at Bonnybridge, has been appointed Manager of the Markinch Gas Company, and takes up duty there on the 1st of May.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 835.)

LAST week on the Stock Exchange achieved some distinction. A long nineteen-day account was concluded; and all are agreed that it was about the heaviest known. As yet, no casualties are reported. However, the onerous burden of the settlement could not extinguish the ardour of the speculative markets, and business there was at high pressure. The opening on Monday was cheerful mostly, though Consols were weak. Railways were active and full of rise; the Foreign Market was firm; and the fashionable speculatives went well. On Tuesday, the general characteristics were much the same; but Americans were uneasy on strike alarms. Wednesday was perhaps even better pretty well all round, except in Americans, and business was quite active. A change came on Thursday; and the rise was stopped by the inevitable move to realize which follows upon a sharp advance. But gilt-edged were better, and Consols had a small rise in spite of dearer money. American, too, cheered up a bit. The selling to secure profits continued on Friday, and prices shrank up to a period; but later in the day there was a sharp rally in all the popular speculative lines. This movement continued on Saturday; while Consols were firm and unchanged, and Railways stronger. In the Money Market, there was a good demand for short loans, and rates profited accordingly. Discount terms were irregular. On Thursday, the Bank rate was raised to 4 per cent., from the 3 per cent. rate fixed five weeks previously. Business in the Gas Market was scarcely as abundant as in the preceding week, owing in some measure to a lull in the activity of the Argentine Companies, which was not fully compensated by an increase in the activity of the Continental undertakings. Several quotations advanced, and the tendency generally was favourable. Additional evidence of the popularity of gas investments may be found in recent sales at the Mart. In Gaslight and Coke issues, the ordinary was well dealt in every day; but prices were rather easier. The opening figures were 104¼; and these were not exceeded during the rest of the week, while on Friday one bargain was marked at 103. In the secured issues, the maximum changed hands at 88¾, the preference at 104 and 105, and the debenture at from 80 special to 82. South Metropolitan was quiet and very steady—all transactions being within the limits of 121 and 122, as the week before. The debenture marked 82 and 82¾—a fall of 1. Nothing at all was done in Commercials; there being apparently no stock in the market. Among the Suburban and Provincial group, Alliance and Dublin was done at 87½, Bournemouth "B" at 16⅜, Brentford old at from 251 to 252½, Brighton original at 214 *ex div.*, Ilford "A" at 147 *cum div.*, and on the local Exchange Liverpool "B" at 164½. The Continental companies were active and strong. Imperial was marked at from 176¼ to 178¼ (a rise of 1), ditto debenture also rose 1, Union made from 97½ to 98¾, European fully-paid from 24⅛ to 24¼, and ditto part-paid 18¾. Among the undertakings of the remoter world, Bombay part-paid changed hands at 4⅛, Monte Video at 13 and 13¼, Primitiva at 7⅝ and 7 1/16, ditto preference at from 5⅝ to 5½, ditto debenture at 99⅝, River Plate at 17⅞, and San Paulo at 16.

ELECTRICITY SUPPLY MEMORANDA.

An Official Explanation of Rules and Regulations—Unremunerative Free-Wiring Scheme—A Contracting Firm's Assisted-Wiring Project—A Queer Deadlock.

THE great safety of electricity supply—a safety recognized only in electrical literature, and not privately by its authors—calls, as our readers are aware, for rules and regulations by the hundred. But, except under the Factory and Workshops Acts, there does not appear to be any supervising authority to see that the rules and regulations are obeyed. The Institution of Electrical Engineers, the Fire Offices, the Board of Trade, and the Home Office have all framed regulations for the protection of the public and property; but electricity itself, human indifference, and competitive finesse override them all. Under the circumstances, the making of the regulations has its serious and its humorous sides. It will be remembered that in 1908, the Home Office, in pursuance of the powers conferred by the Factory Acts, composed certain regulations for the generation, transformation, distribution, and use of electrical energy in premises under the Factory Acts. The regulations incensed the electrical industry from top to bottom; and the Home Office thereupon appointed a Commissioner (Mr. James Swinburne) to inquire into the objections, with the result that there was some revision. Even then there was not happiness. It transpires that few people, after all that has been done, understand the regulations; and the Home Office has been inundated with inquiries for explanations. So great has the trouble been, that the Chief Electrical Inspector of Factories (Mr. G. Scott Ram) was instructed to prepare a memorandum explaining the effect of the regulations, and the exemptions allowed; and he has faithfully performed his task. Thirty-two regulations have required fifty-three closely printed octavo pages to explain them. This may not be the end; for in a prefatory note, the reader is asked to understand "that the Secretary of State has no power to give an authoritative interpretation of the regulations—that is for a Court of Law—and the memorandum is, of course, subject to revision as experience accumulates or fresh discoveries are made." Already there is a call from electricians for an explanation of the explanations. This being so, and as we have not space for a complete review of the memorandum, gas engineers and managers of gas engineering shops who have electrical installations on their works should obtain a copy (it only costs a few pence), and mentally exercise themselves in trying to find a happy issue out of the explanatory labyrinth.

If not altogether successful in this, we promise them they will find instruction on many points in the production. Under section 79 of the Factory and Workshop Act, 1901, the generation, transformation, distribution, and use of electricity have, in factories and workshops, been certified as dangerous; but, until this memorandum has been studied, electricians themselves have to confess that they do not know how dangerous electricity really is. Let us take an illustration or two. Transformers are common things where low-voltage metallic filament lamps are employed. We read:

> Auto transformers are very frequently used to reduce the supply voltage for use with metallic filament lamps. Thus, the supply to any premises may be at 250 volts. This is taken to an auto-transformer, from which a circuit is taken having, for example, only 50 volts between the conductors; and this is used throughout the installation. The question is whether this 50-volt installation may be regarded as under the exemption. In this class of transformer, the lower pressure circuit does not form a separate system. It is quite possible that the 50-volt circuit may be at 250 volts above earth; and therefore just as dangerous as regards shock as if there were no transformer.

Of course, if the 250-volt supply system has one conductor permanently connected to earth, it is possible so to arrange the 50-volt circuit that the maximum pressure above earth shall not exceed 50-volts. Again, if we want an illustration of the refined care and precautions necessary in wiring, we have it here:

> Where metallic tubing or casing is used, it must be efficiently earthed. In an installation where the wires are protected throughout by substantial metallic tubing, the earthing can be simplified by making the separate lengths of tubing electrically continuous; so that actual connection with earth at one or two points only may be sufficient. But if so, the joints between the lengths of tubing must be mechanically strong—*e.g.*, screwed together—as otherwise electrical continuity may after a time be destroyed. The mere sliding of the end of one tube into a socket of another is not sufficient. In whatever manner the joints are made, it is essential that the surface of contact should be of clean metal, free from any paint, red lead, enamel, dirt, or other substance which might impair the electrical continuity. Unless joints are sound, efficient earthing can only be accomplished if the separate lengths of tubing are otherwise specially bonded, or if a connection from an earth wire is made to every separate length of tubing—methods which would probably lead to greater expense and trouble. If the continuity of the metal tubing is anywhere interrupted, care must be taken to bond all the tubes electrically across the break. Thus, where wooden distribution cabinets are used, all the metal tubes leading to and from the cabinets must be electrically bonded together. The use of thin metal tubing and imperfect joints has proved *a fruitful source of danger from fires;* and too much stress cannot be placed upon the necessity for using tubing of adequate thickness with sound joints. In installations covering a large area, where the tubing may be of considerable length, even if it be of adequate thickness to afford sound mechanical protection, it may be of too high a resistance to act as an efficient earth connection, and may have to be supplemented in this respect by an earth cable connected at different points. If parts only of the wiring are in metal tubing, it is equally necessary that every such part shall be properly earthed.

Switches, conductors, motors, portable lamps, and a hundred-and-one other things are dealt with. And so we go on. Loopholes for danger are pointed out on every page of the memorandum; and one leaves its perusal fully persuaded that it is a life's work to become master of all the precautions necessary to safeguard life, limb, and property where electricity is concerned. If one could only see, smell, or hear electricity, it would be something towards ensuring protection. Though valuable and a friend in many respects, electricity is a terribly insidious enemy.

Many local authorities have been seriously bitten by free-wiring. But still there seems a perennial fascination about the idea for municipal dabblers in the administration of electricity undertakings; and the accumulation of experience does not appear to act as a deterrent. So the game goes on merrily, until one after another the municipal adventurers fall out of the ranks of the free-wirers with a large load of unremunerative capital at their backs. The District Council of Beckenham once upon a time approved of a free-wiring scheme. It was going to do wonders for the electricity undertaking; and they set to work with a right good will, which was carried to a point of wholehearted prodigality by the generous feelings entertained for the electricity concern. The result has been disastrous. From a statement prepared by the Clerk to the Council, the expenditure has amounted to 23s. 3d. per free-wired lamp installed; and the Council have no less than £22,613 locked up this way. Rentals last year amounted to only £935, which showed a deficit, after meeting interest and sinking fund charges, of £1708, or (roughly) no less than 1·7d. per unit sold to the consumers on this system. The private consumer pays 5d. per unit; so that if the rental loss is deducted from 5d., it follows that the free-wirer has only been paying 3·3d. per unit. It is the old tale in connection with electricity supply. All these departures from commonsense business method do damage to someone—and it is generally the poor ordinary lighting consumer. Something has to be done to alter the

position in which Beckenham finds itself in this matter; and having in view the foregoing figures, one is disposed to agree without reserve with Mr. A. H. Dykes, the retiring Chairman of the Electricity Committee, that unless the free-wired consumer is prepared to guarantee at least the actual amount that he costs the station, the Council are not justified in spending public money in wiring his house.

The electrical industry likes to nurse the fallacy that it is the question of wiring that stands in the way of rapid headway being made in connecting-up new consumers. Hence free-wiring and assisted-wiring schemes. That the contention is a fallacy is evidenced by the fact that free-wiring and such-like schemes have so often been a failure, and have been ineffective in creating a lucrative business for the electrical concerns that have tried them. Assisted wiring has just been exercising the Brighton Town Council. It comes as a shock to learn that anybody who lives at Brighton, and thinks he or she can afford electric lighting, should require any assistance in making an installation. But it was not the Council who were proposing to run any risks in this assisted-wiring business; but a firm of would-be public benefactors, Messrs. Page and Miles. What they were suggesting to the Corporation was that wiring and fittings should be, in the first instance, provided free by the firm; the expense to be recouped by an extra charge of 1d. per unit on the consumers' current (prepayment meters being used); and the additional 1d. per unit handed over by the Corporation to the firm. When the consumption reached an average of 240 units per point installed, the whole installation was to become the property of the consumer. So that, supposing the consumer had twenty 16-candle points, when his meter showed a registration of 4800 units (the additional 1d. by that time having amounted to £20), the installation would become the consumer's property. It seems to us that some of the consumers would have to start fairly young on this job if they desired to realize the enjoyment of ownership in the installation. But stay, it is just possible that, before that happy time arrived, the "property" would stand in need of renewal; and the expectant property owner would have to bear the expense of this. The Electricity Committee were in favour of Messrs. Page and Miles' proposal. The other electrical contractors in the borough were opposed to it; and some people are rude enough to say that the Gas Company were exercising beneath the surface some amount of influence. However that may be, the fact remains that the Council bundled the stupid proposition out by 21 votes to 10. There is no likelihood of the Council attempting to enter upon the work themselves; for has not Brighton been surfeited with the indigestible fruits of municipal trading?

A "Borough Electrical Engineer" is in sad trouble. Peradventure if we explain its nature, one at least of our readers will be able to put a name to the electrical engineer and the undertaking to which he refers, and perhaps be able to place a different complexion on the matter. Our friend has been airing his grievance in the "Electrical Review," and he asks the editor to express his opinion, and other engineers similarly situated theirs. The editor does not comply; and the "Borough Electrical Engineer" leads us to suppose that he does not expect many opinions from other quarters, as he is good enough to say in his concluding paragraph "that there cannot, of course, be many instances of the sort." The grievance is this: The Borough Gas and Electricity Departments are under the control of one Committee. The gas-mains are alleged to be in such a deplorably bad condition that "a large quantity" of gas is allowed to continuously escape. The electrical conduits and box chambers are also apparently in extremely bad case, as they allow the gas to have free access to them. There have been explosions; and there has been a conduit fire. Reports have been frequently made to the Committee, letters have been often written to the Gas Department, the electricity system reeks. But the Gas Department goes on its way sinning, and takes no heed of the complaints. The Electricity Department suggests to the Committee that the Gas Department should lay new mains; the counter proposal is that the former should ventilate their conduits and boxes. The Electricity Department is prepared to do so if the Gas Department is willing to share the cost. But the former says nothing about bearing a proportion of the expense of laying new gas-mains. There is a deadlock, as the Committee will not consent to the Gas Department bearing any share of the cost of ventilating the electrical system. Now what is this "Borough Electrical Engineer" to do? The Board of Trade regulations state that, if gas is found in any of the chambers or conduits, notice shall be immediately given to the gas undertaking. But plaintively asks the correspondent, "What is to be done if, after such notice is given, the gas undertaking pays no attention to it? Is the Board of Trade to be notified?" Can any of our readers make a suggestion that will give this unhappy mortal relief? Perhaps if his Committee find out that he has been in communication with the Press, he will be relieved of all further care and sorrow so far as his present appointment is concerned.

Glover-West Retorts for Rochdale.—It will be seen, from a report which appears elsewhere, that the Gas Committee of the Rochdale Corporation have decided to put up an installation of Glover-West vertical retorts in connection with the gas-works extension scheme to be carried out under the supervision of Mr. T. Banbury Ball, the Engineer.

THE WILLIAM YOUNG MEMORIAL.

We learn from a circular issued by Mr. Alexander Bell, of Peebles, the Hon. Secretary and Treasurer to the William Young Memorial Committee, that the Committee have carefully considered various proposals in connection with the memorial, and have unanimously agreed that it should take the form of a lectureship. For this purpose a capital sum of £600 is required. The amount will be settled on Trustees under a trust deed defining the purpose for which it has been raised, and thereby securing that the proceeds will be applied to this purpose only. The fund will be known as "The William Young Memorial Lectureship Fund." It will be invested, and the income devoted to providing a biennial lecture, to be delivered at a general meeting of the North British Association of Gas Managers, who initiated the project. It will be known as "The William Young Memorial Lecture," and will deal with the chemistry, the manufacture, the distribution, and the application of gas.

In asking support to this scheme, the Committee point out that, while the primary object is to provide a lasting memorial to Mr. Young, the project has also a practical aspect, which is of great importance to the Association. From the former point of view, the lecture, recurring every second year, will certainly serve to perpetuate the memory of Mr. Young, who, as a distinguished member of the Association, contributed so much to the success of its meetings, and to the advancement of the gas industry, by his frequent papers and communications. Indeed, the Committee consider no better memorial could be devised than this, which in a sense continues the good work which, for a lifetime, Mr. Young did in and for the Association. As regards the practical aspect, the lectures will be delivered by eminent men, and will deal with the latest developments in each department. It will therefore be seen of what great importance these lectures will be to the members, and how much they will enhance the already valuable proceedings of the Association. This especially, in the opinion of the Committee, should secure for the scheme a generous response. Contributions have been promised to the amount of £228 9s.; and it is hoped the rest will be promptly subscribed.

With the view of enlisting the co-operation of those who control the financial department of gas undertakings, such as directors and gas commissioners, in the scheme, a letter addressed specially to them, embodying the foregoing particulars, accompanies the circular; and emphasis is laid therein on the great benefits which will accrue to managers who are members of the Association, and through them to the company or the gas department they serve, by the delivery of these lectures. The Committee therefore express the hope that their appeal may result in some handsome contributions to the fund.

NOTES FROM WESTMINSTER.

In a quiet manner, the Upper and the Lower Houses showed last week an interest in Private Bill Legislation, by each having a Select Committee at work, and both with gas measures in the groups allotted to them. The Commons Committee, over which Mr. Arthur Stanley presided, had before them the Brighton Gas Bill in connection with which quite a big fight was made. The Committee have still the East Grinstead Gas and Water Bill, the two Mallow gas measures, and the Tipperary Gas Bill to consider; but we doubt whether they will get much further with their work this side of Easter, in view of the fact that they did not sit yesterday and Parliament rises for a brief recess to-morrow. The Lords Committee disposed of three gas measures, as will be seen by the accompanying notes; and in regard to the other three Bills in their list—Southend Water, Thorne and District Water, and Wicklow Gas—opposition has been withdrawn. The Whitland Water and Gas Bill has now been dropped. The Standard Burner Bills have been referred to a Committee over which Lord Joicey will preside; and the Committee will hold their first sitting on Thursday, April 7. Lord Joicey has a large experience in the colliery and commercial world; and what is brought before him and his colleagues will undoubtedly be examined carefully from a practical standpoint. The Glasgow Order, in which, *inter alia*, illuminating power and the standard burner are being dealt with, is now to go forward as a Bill. In connection with Water Bills, it is noticed that instructions are again being given to Committees to inquire whether promoters have made adequate provision in their measures for the supply of water at reasonable rates to the agricultural communities within their areas of supply, and to any person or persons from whom any existing or natural supply is, or may be, withdrawn owing to the works authorized by the Bill, and, if thought proper, to impose the obligations.

Brighton Gas Bill. A long line of Counsel, a good body of witnesses, and numerous interested spectators were in the Committee room when the Chairman of the Commons Committee selected to consider, among others, the Brighton and Hove Gas Bill took his seat last Tuesday morning at the hour appointed, and sat there awaiting the tardy arrival of colleagues to form a quorum. After a little delay, two other members put in an appearance; and Mr. Balfour Browne, K.C., at once proceeded to address the Committee, informing them of the objects of the Brighton Bill and of the contents of the petitions

that had been presented by the opponents. The opposition were represented by the Brighton Corporation, the Hove Corporation, certain District Councils, and the East Sussex County Council. Perhaps no one was more surprised than the Gas Company at the character of the demands and case generally that had been concocted by the opposition—some of the matters being anything but pertinent to the measure, and, as a matter of fact, some of them bordered upon, if they did not pass over into, the impertinent. Matters that have been accepted by Parliament, and have been incorporated by the authorities of the two Houses in the model clauses, and in many Bills, were attacked, and new claims were placed on the table. But, after best part of a week's deliberation, what, save in the case of the out-districts in the matter of the differential price, good has all the opposition done? It is true that 1d. (and not 3d. as demanded) has been unfairly cut off the standard price; but what does that amount to? To maintain the shareholders' dividend, the Company will have to work to supply gas 1d. cheaper per 1000 cubic feet; and merely the few hundred pounds that the shareholders would have received on the next reduction (which would have been made as soon as the Directors were in a position to do so), will be denied them. At the same time, the compulsory reduction of 1d. in the price of gas will not be to the benefit of the municipal electricity undertaking. Seeing that the Gas Company were not proposing a reduction of the nominal illuminating power of the gas, but only to adopt the "Metropolitan" No. 2 burner, and seeing also the protection that the consumer has in the sliding-scale, having regard, too, to the huge investment of capital that has been made on the faith of Parliament maintaining the standard price which Parliament itself has allowed, the reduction, though only by 1d.—from 3s. 3d. to 3s. 2d.—of the standard price is quite unjustified. That, however, and the lowering of the extra price in the outer districts from 6d. to 3d., constitute the only two points where the Company were scathed, and then not deeply. The promoters' requests were all (as will be seen by turning back to our review when dealing with the Gas Bills lodged for the session) of ordinary character in modern gas legislation, except in regard to the institution of a capital redemption fund. The case for the Bill was supported by the Chairman of the Company (Mr. A. M. Paddon), Professor Vivian B. Lewes, Mr. E. L. Burton (Secretary), Mr. Joseph Cash (Engineer), Mr. H. E. Jones, and Mr. E. H. Stevenson. Mr. William Newbigging appeared for the out-districts, but chiefly in regard to the differential price. Mr. Isaac Carr and Mr. J. G. Newbigging were present to support the claim to something substantial for the consumers for the damage—fancied by the witnesses, but not felt in the experience of consumers—sustained by the adoption of the new test-burner. Dr. Haldane was also called, on a Speaker's order, to give evidence with reference to the opposition claim for restriction in the use of carburetted water gas, with a somewhat disagreeable result for those who were instrumental in bringing him to the Committee rooms.

Calorific Power. There is no doubt that the question of calorific power will be pressed in this and future sessions for all it is worth by those who suggest opposition cases to Gas Bills. But, on the other hand, there is no doubt that Parliament will not impose it while the illuminating power test stands. It was refused by the Lords Committee in the Farnham Bill last week; the Brighton Company's opponents withdrew their claim for a standard and test when they saw they had not a leg to stand upon, so long as the illuminating test remained. And it was clear the Committee were not in sympathy with these attempts to cast undue burdens upon, and to unnecessarily harass, private enterprise. When the opponents are asked to be fair, as they were by Mr. Balfour Browne in this Brighton case, and requested to choose between the illuminating power test and that for calorific power, they prefer to maintain the *status quo* rather than adopt something of which it is palpable they know, and really care, little, though at the same time local authorities who are electricity suppliers prefer to tie the hands of their competitors as tightly as possible, and have no prickings of conscience regarding the nature of the bonds employed. The unfairness of the dual test was shown to the Committee by Counsel and witnesses; and Mr. Joseph Cash at present does not seem to be particularly in love with the test, as, in the event of the interruption of the supply of a good quality of coal, he does not quite know how deficient calorific power is to be readily made up, as can be done in respect of illuminating power. All the technical witnesses, however, were in agreement that a calorific test would come, but only in substitution of, and not in addition to, the illuminating power test. "There is not the least doubt," says Professor Lewes, "when you have it realized how important calorific value is, that the calorific test will come in place of the illuminating power test." But he adds what is tantamount to a warning: "As a gas examiner, and knowing a good deal about the manufacturing processes of the country, I should certainly say it would be indefensible to hamper and strangle any industry by putting upon it too many tests." The opponents of the Bill placed at 3 per cent. the reduction of calorific power per candle reduction of illuminating power; but that can only apply to specific conditions. Why is it that with the 10 to 12 candle gas made in the Dessau verticals in Berlin, a net calorific power is obtained equal to London gas? But after all, the 3 per cent. reduction is the result of a laboratory test, is not great, and has no perceptible or practical significance in the use of gas under ordinary household conditions. In household use, there are not the refinements of the laboratory tests.

Suggested Water Gas Restriction. As already mentioned, the opposition made a little essay to put a limit on the use of carburetted water gas by the Brighton Company; and, at the instance of the opposition, a Speaker's order was issued calling upon Dr. Haldane to give evidence on the subject. It was expected by those who were instrumental in bringing him before the Committee that, in view of his share in the famous Home Office report of 1899, Dr. Haldane would have blessed the proposal of the opponents to forge this particular additional shackle for the Brighton Company. But in the course of his cross-examination, he showed that the discretion of gas authorities and changed conditions have modified the necessity for legislation, and that, if legislation there ever should be, it should be general, and not inflicted spasmodically and in isolated cases. The matter is dealt with at greater length in our editorial columns.

Redemption Funds. Reference is also made in the same editorial article to the question of capital redemption funds under exceptional circumstances. And again we need only say here that despite the Brighton Corporation submitting that the proposal was unprecedented and unjustifiable, the Committee have allowed the Company to create such a fund in order to extinguish £57,000 of capital, representing works discarded on the concentration of the manufacturing plant at Portslade. The House of Lords Committee have also passed a proposal in the Bishop's Stortford Gas Bill, by which such a fund will be permitted for reducing the capital to £400 per million cubic feet of gas sold. Here, again, there will be works that will be abandoned in favour of concentration. There is precedent for a redemption fund in the Gaslight and Coke Company's Act of 1903. The subject is further discussed in the article to which allusion has been made.

An Essex Amalgamation. Work also commenced in the House of Lords Committee rooms on Tuesday morning; and, as a matter of fact, half-an-hour earlier than the time at which the Committee of the Commons assembled. The Lords Committee in which we were interested was the one of which Lord Hylton had been appointed Chairman; and they had had allotted to them a little group mostly comprising gas and water measures. The brief preliminaries having been passed through, Mr. Honoratus Lloyd, K.C., was on his feet, introducing to their Lordships' notice the Bill in which it is proposed that a number of more or less small gas undertakings in Essex are to be merged into one substantial concern. The Bishop's Stortford, the Harlow and Sawbridgeworth, and the Epping Companies are to be amalgamated; in the new concern are to be vested the Ongar, the Newport (Essex), and the Much Hadham Companies; and there is to be absorption by purchase of the Dunmow Company. The substantial concern that it is proposed by the Bill to create by the fusion of these separate and, being separate, less influential undertakings, will have a large district in which to operate; but we fail to see why the Local Government Board should have had any fear that, or rather suggest that it was a matter for consideration whether, in view of the extensive character of the district, the interests of the parishes would suffer through the gas supply being centred in one Company. Their fear is not endorsed by the Local Authorities—only one of whom (the Bishop's Stortford), out of eight or nine, offered any opposition, and that of a negligible character. It was not endorsed by the Committee; and Counsel and the witnesses called—Mr. E. L. Burton, Mr. H. E. Jones, and Mr. E. H. Stevenson—showed that there was every confidence on the part of the promoters in their ability to serve, and not jeopardize, the interests of the inhabitants of an area measuring roughly 21 miles by 15 miles. There is undoubtedly a big expanse of territory represented by these measurements; but there will be no more difficulty dealing with it than with other large areas. Mr. Honoratus Lloyd traced the financial position of the undertakings which it is intended to bring together for the supply of both gas and electricity; and he and the witnesses impressed upon their Lordships the economies that will arise in working and trading generally through one united Company, and in which economies the consumers will be, under the sliding-scale, greater beneficiaries than the shareholders. The features of the scheme as framed in the Bill were set out in our issue for Jan. 4 last (p. 23); one of the proposals being, as in the Brighton Bill, the creation of a capital redemption fund. As, however, the opposition collapsed on a simple agreement to enable the Bishop's Stortford Council to purchase the electricity undertaking at the expiration of 21 years, there is nothing more that calls for reference here, except to congratulate the promoters (who include Mr. H. E. Jones, Mr. Frank H. Jones, and Mr. E. L. Burton) on the success of the project to this point—a success that indicates a safe journey through the remaining parliamentary stages of the measure.

Farnham Gas and Tests. The next Bill considered by the Committee was that of the Farnham Gas Company, in which incorporation, additional gas powers, and electricity supply authorization were sought. It seemed hardly necessary to drag the Company before a Committee with the objects the District Council had in view. The Council asked for a calorific power test, a testing-station on their own premises, and a lower standard price than that the Company were proposing on the adoption of the sliding-scale. It would be interesting to know who put the matter of a calorific power test into the heads of the Farnham District Council. Estimable gentlemen as the district councillors doubtless are, making a

cursory survey of representatives a conviction takes hold of one that before the Bill was introduced, they knew little or nothing about a test for the calorific power of gas, and they know precious little more about it now. We venture to say that, as a matter of fact, they personally do not care a fig about it. Much the same may be said in regard to the testing-station at the Council's offices. So concerned are the Council about illuminating power tests that they have made use of the present testing-station, only a few yards from their offices, merely three times in four years! It is ludicrous to waste the time of a Parliamentary Committee in this way. It was an instance in which there was great poverty of material on which to present any case for opposition. The Company propose to reduce the illuminating power standard from 15 to 14 candles, and to fix the standard price at the present maximum of 3s. 9d. Mr. E. H. Stevenson gave evidence to the effect that the reduction of 1 candle in illuminating power would represent a saving of ¾d. per 1000 cubic feet. The Council, however, asked for a reduction of the proposed standard price by 5d., making it 3s. 4d.—the present price of gas. The Committee's decision, placing the standard at 3s. 6d., showed the claim of the Council to be, in their opinion, unreasonable. They rejected the request for a calorific power standard and test, and made no change other than that of standard price in the Bill. In addition to Mr. Stevenson, Mr. F. H. Jones gave evidence for the Company, while Mr. Charles Hunt appeared for the Council on the subject of the standard price.

Gowerton Regenerate. There is a little doubt as to the suitability of this side-heading. When once a dog has earned a bad name, it is a difficult thing for the animal to set himself right with humanity again. The Gowerton Company come from the Eaton stock; and Eaton, according to Mr. Wedderburn, K.C., has cleared out. Sir Charles Soames has also beat a more or less dignified retreat; and Counsel and Mr. Stevenson assured the Committee that the Company are now on the high road to an honourable existence, and that there is good scope for them to work in a small way *pro bono publico*. We hope for the best. The information laid before the Committee revealed the old game of the original promoters of the concern, in trying to plunder shareholders by asking fancy prices for plant and so on, getting all they can, and then leaving the concerns wrecked and over-burdened with capital. The Law Courts have produced a goodly tale of receiver appointments of late—due to Eatonsque exploits. The only opposition was from the Swansea Rural District Council, who through Mr. Freeman, K.C., stated that they preferred that the Swansea Gas Company, and not the Gowerton one, should have the right of supplying Penderry and Cockett. For this very purpose, the Swansea Company have a Provisional Order before the Board of Trade at the present time, and decision on this awaits the assertion of the preference of Lord Hylton's Committee. This has now been declared; and the Swansea Company gain the extension. But are there not certain omissions in the Gowerton Bill—such as the auction clauses—in regard to which the authorities of Parliament are generally credited with being particularly lynx-eyed? There are also Bills in which dividends are not specified. Such departure from parliamentary custom in gas measures has, of course, a tendency to raise doubts.

HEAT INSULATION OF RETORT-SETTINGS.

Some particulars were given in the "Journal" during 1907 (Vol. XCVII., p. 543) of an insulating material, "Thermalit," which had been used by Herr J. Arnold, the Superintendent of the Gaudenzdorf Gas-Works at Vienna, to hinder the passage of heat from the faces and tops of retort-settings. The material is a preparation of "kieselguhr," of a highly porous character and having a specific gravity of only 0·3. It is fire-proof and may be exposed directly to a dry heat of 2000° Fahr. without suffering depreciation. We have satisfied ourselves that a sample of it which has been submitted is not appreciably affected by dilute acids, alkali, or high temperatures. The material is stated—according to figures of a trial which have been put before us by Corkstone Company, of Arlington Street, Islington, the vendors of it in Great Britain—to insulate a steam pipe 7 inches in diameter so efficiently that there is a drop in temperature from 434° to 423° Fahr., or only 11° in the superheated steam in a length of 62 feet. This corresponds to a total loss of heat of 2·6 per cent. per 100 square feet of surface. The pipe was covered flush with the flanges with 2 in. of "Thermalit." The material is made up in sectional moulds 2 in. thick for any sized pipes, and in slabs and bricks of the standard size of 10 in. by 5 in. and either 2 in. or 2½ in. thick. In addition to its use for superheated steam plant, it has been applied, as already stated, to the insulation of the faces, back walls, and crowns of Austrian retort-settings with apparently satisfactory results, though we are not aware that Herr Arnold of Vienna has yet fulfilled his promise to report the saving in fuel in retort-settings fitted with it. A later use of "Thermalit" is for the insulation of coke-ovens built in the open; the object of the insulation being not merely to conserve the heat of the oven, but also to protect the outer brickwork from the injurious action which occurs when it is exposed at a high temperature to atmospheric cooling influences. The material is made in Austria by the works which manufacture the "corkstone" insulating materials for which the firm already mentioned are likewise agents in this country.

THE NATIONAL PHYSICAL LABORATORY WORK.

The Royal Society issued invitations for the customary annual reception, which was held last Friday, at the National Physical Laboratory; and a large number of guests availed themselves of the opportunity of inspecting the new buildings and new equipment of the institution. The coincidence of the function with the annual meeting in London of the Institution of Naval Architects, was a happy arrangement, since those attending that meeting were enabled without difficulty to see the national experimental tank which has been constructed at Bushey and is now being equipped. The provision of this tank is due to the generosity of Mr. A. F. Yarrow, who gave £20,000 for the purpose. A fund sufficient for its maintenance for a period of ten years has been raised by the Institution of Naval Architects, who have the nomination of the Advisory Committee under whose direction the work and the investigations carried out in the tank will be conducted.

Passing from this matter—which was the topic of most of the conversation of visitors at Bushey House on Friday afternoon—to points of more special interest to "Journal" readers, we may say that a great deal of valuable research work appears to be in progress in the Photometry Section, under the supervision of Mr. C. C. Paterson, Assoc.M.Inst.C.E., towards the establishment of sets of electric sub-standards of light. The standards which are now under trial consist of tungsten filament large bulb lamps. Working at about 3·5 watts per candle, comparisons can readily be made between these lamps and the Harcourt 10-candle pentane standard. When the electric lamps come to be burnt at a higher efficiency, the colour begins to approach to that of the metallic filament lamps used by ordinary consumers; and at the present time metallic filament lamps sent to the laboratory for examination are compared with tungsten sub-standards working at two watts per candle. The colour difference in this case is stated not to be serious, though it prevents the certification of the lamps to as high a degree of accuracy as would otherwise be possible. So far, lamps operating at 1·5 watts per candle, which would admit of better comparisons being made, have been found to be subject on life test to small fluctuations (for which there is no satisfactory explanation) in candle power, and hence they are not yet available as sub-standards. This branch of work is of great importance, as suitable standards are urgently needed for testing the performances of metallic filament lamps, and accurate comparisons are difficult, if not out of the question, between these lamps and existing standards, owing to their great differences of colour. The task of establishing satisfactory sub-standards has, however, proved very arduous, and Mr. Paterson is to be congratulated on having already made such good progress. We refer to this point at some length, in view of Professor Fleming's disparaging remarks on this branch of the work of the laboratory reported in another column of to-day's "Journal."

The unit to which all sub-standards are referred is the candle represented by a tenth of the light afforded in normal conditions by the Harcourt 10-candle pentane lamp introduced by the Gas Referees in 1898, and of which the National Physical Laboratory has at least one example certified as correct by that body. The continuity of the standard candle used in gas testing is thus ensured; and its general application in place of the Hefner for the rating of electric lamps can now only be a matter of a few years so far as this country is concerned. While the Harcourt lamp itself will doubtless continue to be used as the working standard in the photometry of a gas-flame, because the light of the two will vary *pari passu* (or nearly so) with changes in atmospheric conditions, obviously electric sub-standards, based on the same candle-unit, are more suitable for testing the light of electric lamps; and their use will extend in the photometer rooms of electricians. An attempt has been made to deduce a formula for converting the humidity values found in the still air of a room by the ordinary Mason's wet and dry bulb hygrometer into the values which the Assmann ventilating hygrometer would give for the humidity of the air of the room. It would hardly seem likely that it would be possible to deduce any simple relation between the readings of the two instruments in varying conditions of temperature and humidity; and it is therefore the more interesting to note that the report of investigations that were carried out during the past year at the National Physical Laboratory speaks hopefully of the deduction of a simple formula for the correction of the ordinary wet and dry hygrometer readings. We hope that these investigations will soon reach a successful issue. Meantime, we may remark that it is perfectly easy to get concordant readings between an ordinary wet-bulb thermometer and the wet-bulb of an Assmann instrument if the former is placed in the draught created by a small fan, such as an electric table-fan, or is waved quickly to and fro in the air. The Assmann hygrometer, as made in Berlin, is at present an extremely costly piece of apparatus, notwithstanding the simplicity of its construction; and those who do not care to buy it may be glad to know that simple wet and dry bulb thermometers, if used in the manner just indicated, will give the same readings. We should prefer readings thus obtained to those deduced from any formula.

The National Physical Laboratory is about to make a series of determinations of the light afforded by the Harcourt 10-candle lamp, when a light petroleum of higher boiling point than pentane is used in it in place of pentane, the use of which is precluded in

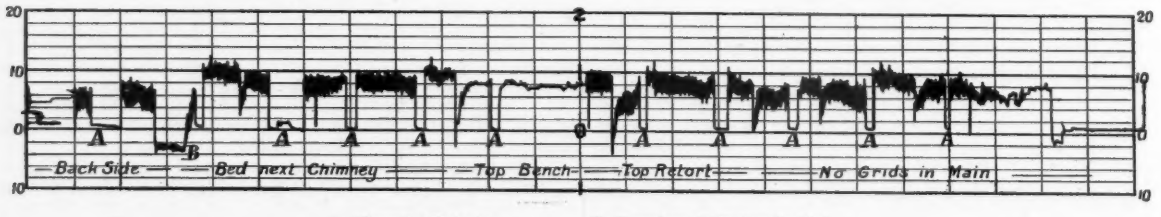
really hot climates. We believe it is already known that there is no appreciable alteration in the light yielded by the lamp provided the temperature is sufficiently high to volatilize the petroleum spirit at about the rate at which pentane volatilizes at ordinary temperatures, and provided the petroleum spirit is derived from the same raw material and purified in the same way as pentane. A useful research to which the Photometry Section of the National Physical Laboratory might well devote some time in the interests of technical men is the comparison of the results of different methods of ascertaining the mean spherical and mean hemispherical illuminating power of sources of light. At present, consultants and others who are called upon to make these determinations in the ordinary course of their professional work use various methods, with the consequence that their results are not always fairly comparable. They would be glad to hear that the National Physical Laboratory will shortly undertake an investigation of existing methods with a view to formulating a generally acceptable method, which could be followed by those engaged in making commercial tests. It is investigations of this character that fall properly within the scope of the activities of a National Laboratory; and as we are glad to understand that the Bushey House institution is now devoting its operations to an increasing extent to work of such a generally useful kind, we throw out the above suggestion in the hope that it will be favourably received by the authorities there.

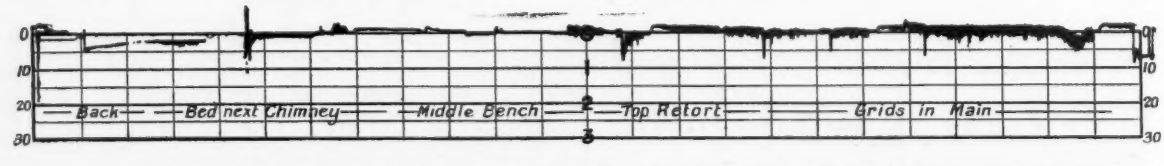
Some researches, which should be of considerable value, are now in progress in regard to pyrometry, and materials for the construction of thermometers for both high and low temperature work. We note that in the department of metallurgical chemistry, where analyses incidental to the research work of the laboratory are carried out, it is intended ultimately to replace all gas-heated appliances by electrically-heated ones. This decision appears to have been arrived at without trial of the high-pressure system of using gas for laboratory furnaces, which Mr. A. W. Onslow, of Woolwich Arsenal, described at a recent meeting of the London Section of the Society of the Chemical Industry. We have no doubt that if the authorities of the Bushey House Institution would seek advice from Mr. Onslow, or chemists who have used his high-pressure heating burners in their laboratories, they would soon be convinced that gas, properly applied, is superior to electricity for providing a readily controlled and constant furnace temperature. The Department of Metallurgical Chemistry has incidentally made a number of ordinary analyses, such as of the laboratory supply of coal gas for the information of the Photometry Section, and of the Portland cement used in the new buildings of the laboratory. There were rumours afloat a short time ago that, as a consequence of these tests, considerable friction had arisen as to the quality of some of the cement supplied.

In conclusion, we may say that it gave us much pleasure to observe on Friday last that the National Physical Laboratory is rapidly extending the sphere of its research work, and that while the investigations of which reports have already been published are still few relatively to the magnitude of the institution, there is every reason to believe that they have been conducted with care, and are of sufficient importance to justify the existence of the laboratory and its maintenance at the public expense. The standardizing work, which was taken over by the laboratory at its start, continues to increase in volume and to be carried out with the precision which earned for Kew its good repute in connection therewith.

MEUNIER'S PATENT HYDRAULIC MAIN FLOATS.

We have received from Messrs. Robert Dempster and Sons, Limited, of Elland—who, as already announced in the "Journal," have been appointed by the inventor Sole Agents for Meunier's patent hydraulic main floats—the accompanying two charts taken by Mr. S. R. Ogden, the Engineer of the Blackburn Corporation Gas-Works, which, they remark, clearly show the benefits in level seals to be derived by the use of the apparatus. The diagrams were taken from hydraulic mains on each side of the same arch. One of the hydraulic mains, which gives a very unsteady gauge, was not at the time fitted with Mr. Meunier's arrangement; while the other, giving a very satisfactory gauge, was so fitted.



A. Changing Retorts. B. Running-off Hydraulic Main.

Appointments in Buenos Ayres.

Now that the arrangements for the absorption of the River Plate and Buenos Ayres New Gas Companies by the Primitiva Gas and Electric Lighting Company of Buenos Ayres have been completed, we understand that the new Board of the Amalgamated Company have appointed as Joint General Managers Messrs. A. Gabarret and M. Obarrio, and as Joint Engineers Messrs. J. M. Rowbotham and W. Angus—formerly the respective Managers and Engineers of the River Plate and Buenos Ayres New Gas Companies respectively. Mr. Bernard F. Browne, who has been acting as Engineer and Manager of the Primitiva Gas and Electric Light Company for the past three-and-a-half years, in addition to having the management of the chemical works of the Company, will probably be leaving in the near future, owing to his having tendered his resignation last year, which he postponed on account of the amalgamation, on the desire of his Directors that he should carry out the transference involved. The progress of the Primitiva Company has been very marked under Mr. H. E. Jones's chairmanship and Mr. Browne's local administration; the gas sales having increased by 40 per cent. and the profits by 25 per cent. in the last three years, in spite of a reduction of 10 per cent. in the selling price. The leakage has been reduced by 7 per cent., and the profits of the chemical works have considerably more than doubled in the same period.

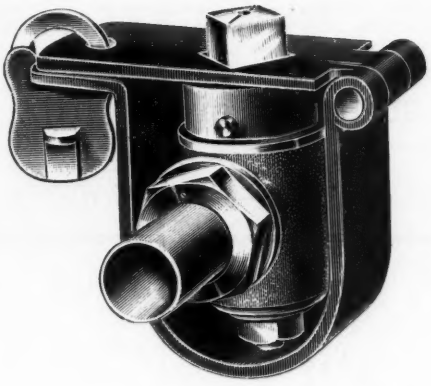
Mr. A. J. Hope, Gas Engineer, of Nelson, has resigned the office to engage in cotton manufacturing.

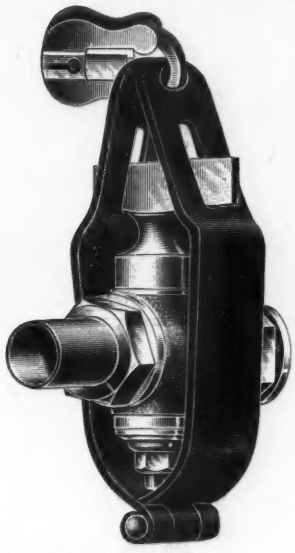
Mr. Joseph Smith, J.P., who has just entered upon his forty-third successive year as Chairman of the Romford Gas Company, has been a Director of the undertaking for forty-eight years.

Testing Water with Calcium Hypochlorite.

Sterilization of the water of the Connecticut River has been investigated at Hartford, to ascertain if an emergency supply can be obtained from that river by treating it with calcium hypochlorite. Except for the fact that the sewage of perhaps 250,000 people is discharged into the river above Hartford, the water is suitable for domestic supply; and experiments were accordingly made by Professor J. A. Newlands, of the Connecticut State Board of Health, and Mr. Harold C. Stevens, of the engineering staff of the Board of Water Supply of New York, to learn if it could be made safe for drinking. According to some particulars in "Engineering Record," the experiments were made by allowing water to flow from the river to a well, and pumping it therefrom through a 16-inch main to a sewer three-quarters of a mile distant. The hypochlorite solution was added to the suction of the pumps, and the character of the treated water was observed by samples taken at four places along the force-main—the last station being at the connection with the sewer. When one part per million of available chlorine was used, the removal of bacteria was always greater than 99·5 per cent.; and the colon bacillus was not detected. With the addition of half as much hypochlorite, a reduction of 99·78 per cent. was detected at the last observing station on a day when the raw water contained 64,000 bacteria per cubic centimetre. Professor Newlands has reported that this treatment, particularly if made with 1·5 parts per million, would yield satisfactory results in emergencies. But he does not believe it should be adopted as a permanent method of purification, unless the water is subsequently filtered, as, in his opinion, great care is necessary, in any such process, in order to eliminate any chances of error in adding the chemical; and the physical appearance of the water is not affected by the hypochlorite employed.

NEWBIGGING'S PATENT TAP FASTENER.





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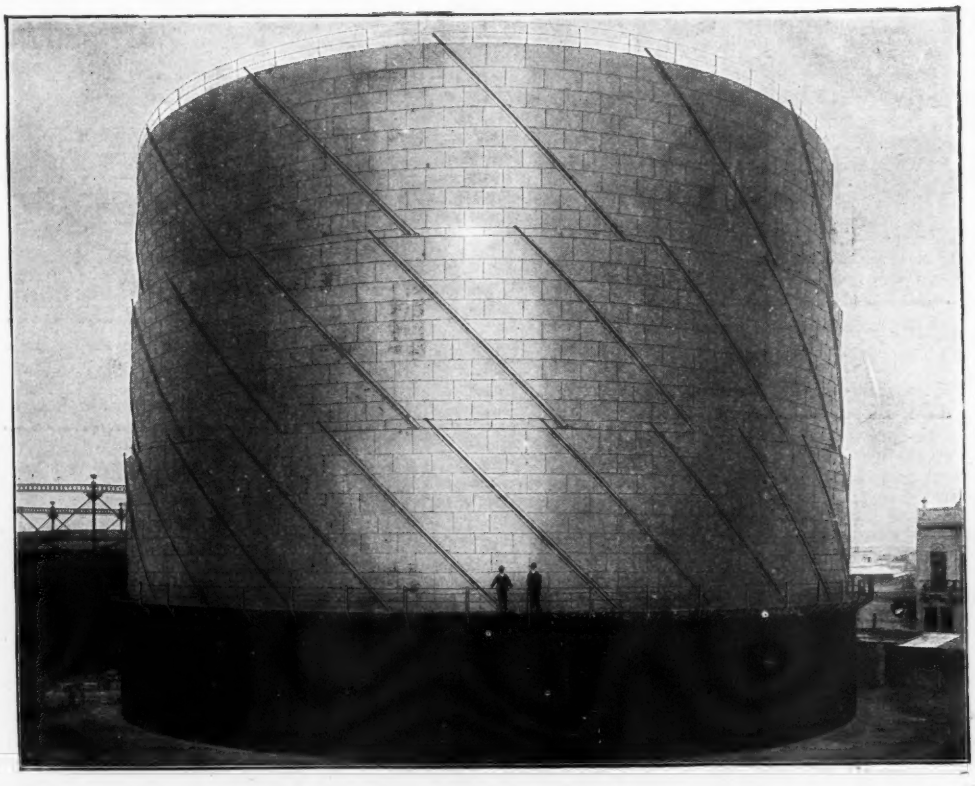

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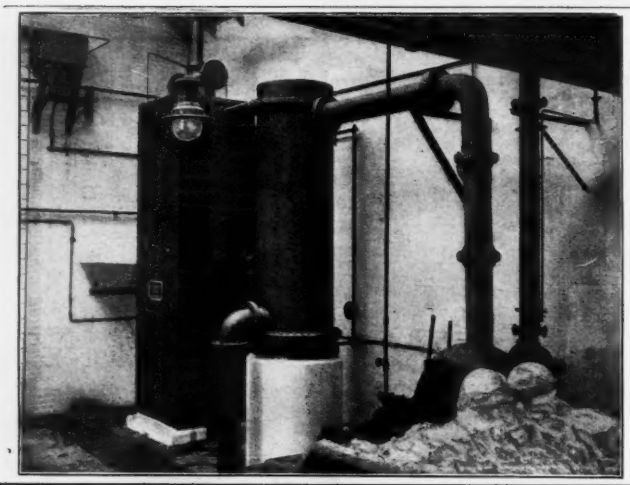

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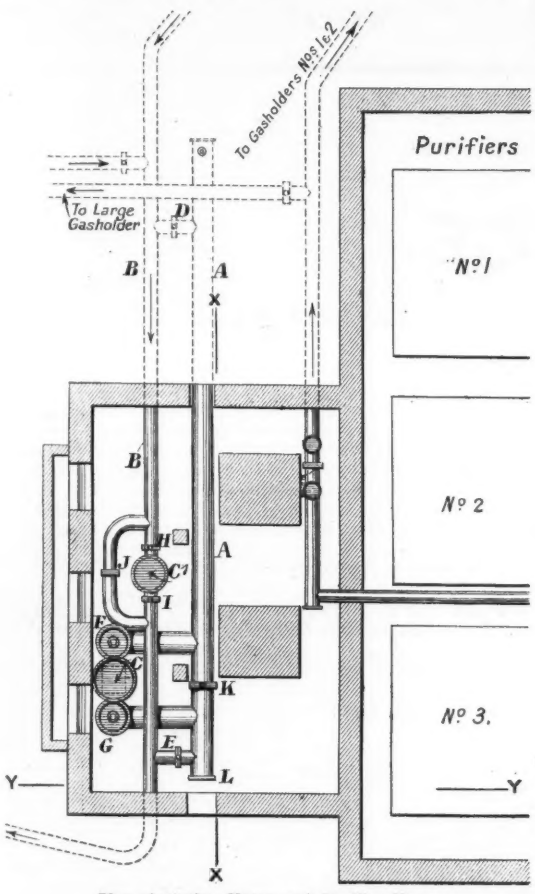
THE EXPLOSION AT THE GENEVA GAS-WORKS.

Official Account of the Accident.

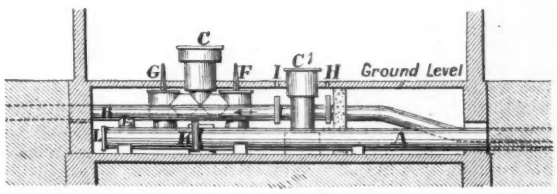
It will be in the recollection of most of our readers that on the 23rd of August last year the gas-works of the Municipality of Geneva was the scene of a serious explosion, which unhappily resulted in the loss of thirteen lives, injury to a number of employees, and considerable damage to the works and neighbouring property. We have been able, from time to time, by means of reproductions of photographs and the few particulars available, to give readers an idea of the extent of the catastrophe. We are now in a position, however, through the courtesy of M. Des Gouttes, the Municipal Gas Engineer, to publish what may be regarded as an official account of the accident, and show, by means of a plan and sections, the portion of the works and plant in which the explosion occurred. For the other illustrations we are indebted to the proprietors of "La Patrie Suisse."



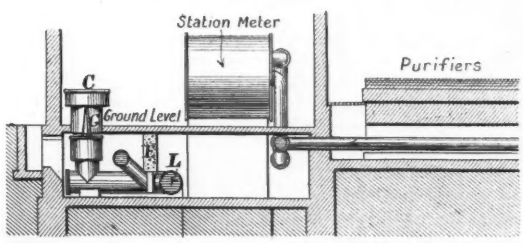
Plan of Station-Meter and Purifier House.

At the outset it must be stated that the accident took place in connection with the laying of a new supply main, and was in no way a consequence of the ordinary operations of the works. The circumstances which gave rise to it are as follows: A 32-inch main had been laid by the side of an old 20-inch pipe in the subsoil of the building containing the station meter and governor. A new 32-inch governor had also been put in. The positions of the two mains, marked A and B, and the two governors C C^1, are shown on the accompanying plan and sections. The larger pipe had been connected to the smaller one by two valves D E, placed respectively outside the building, before the two governors, and in the subsoil, after them. The new main was closed on the works side, just beyond the valve D, by a plate, in view of the erection at some future time of a fourth holder. On the town side it was provisionally plugged at L with a plate of asbestos, another of sheet iron, and a strong wooden disc; all being pressed firmly against the pipe by means of a screw-jack supported by the ground outside the building, at the end of the trench opened for laying the main. This plug was inside the building, and, as shown by the plan, was within about 2 feet of the foundation wall, which had an opening large enough to allow of it passing through. It was the intention of the gas authorities to extend this main eventually in the direction of the city.

The work of fixing the new governor was finished by the 19th of August; and from that day till the 21st it was put under a series of tests. For this purpose, the two bye-pass valves connecting the old and new mains were opened, as well as those of the new governor F G; and during the tests the gas passed through the governor and the 32-inch main. The old governor C^1 was temporarily thrown out of action by the closing of the inlet and outlet valves H I. The result of these tests was very satisfactory. At their conclusion, on the morning of Saturday, the 21st of August. the two bye-pass valves D E were closed, and the gas once more took its usual course through the 20-inch main. The larger main was at once thrown out of use; and therefore it contained only



Section on the Line XX.



Section on the Line YY.

View Taken at the Time of the Explosion and Subsequently Strengthened.

The Large Gasholder Damaged by the Explosion.

the gas remaining after the tests had been carried out. The bye-pass valves J K of the two governors were kept closed during the whole of the tests.

The following Monday, the foreman who, under the direction of the Engineer, had laid the 32-inch main, proceeded, with the sanction of his chief, to remove the temporary plug already referred to. He first took away the screw-jack and the wooden disc, and then, with the assistance of two workmen, removed the iron and asbestos plates. This action left the end of the pipe open, and liberated the gas remaining in it after the tests made at the close of the preceding week. The two men detected the smell of gas; but the foreman remarked that it was only what had been left in the portion of the main between the bye-pass and the outlet of the governor. He then went away to the workshop, to which he had been called; and the two workmen remained in the trench gathering up their tools and the pipe-laying plant.

What occurred after this, nobody knows for certain, because all the witnesses of the accident, and probably those who caused it, are dead. This, however, appears to be the most reasonable explanation: The two workmen—or, at all events, one of them—smelling the gas remaining in the pipe, wished to ascertain whether or not the valve on the connection with the 20-inch main, which was then in use, had been properly closed. Possibly the men may have been ordered to do this. Instead, however, of closing the valve, they did just the reverse; for after the accident it was discovered to be wide open. When it was subsequently tested, it was found that 62 turns were required to open it to its fullest extent. It is inconceivable that one of the two workmen should on his own account have manipulated the valve and opened it. Moreover, one of them had, on the previous Saturday, closed this very valve as well as others in its immediate vicinity, in the presence of the Engineer; and therefore he knew perfectly well

The Purifier-House, at the Side of which the Explosion Occurred.

Ruins of the Station-Meter House.

how it should be worked. It is an internal screw valve, and its rod turns without rising. It is not worked by a wheel, and consequently a key is required. It opens to the right, like the water-valves in the city; and when it is desired to ascertain whether or not one is closed, all that is needed is to give it a quarter, half, or even a whole turn. By this very simple operation any one can satisfy himself as to whether he is opening or closing a valve. It is therefore incomprehensible that one of the men employed upon the works should have turned the valve in question to such an extent as to open it fully. Yet it was in this condition, with the result that it allowed to pass into the subsoil of the station-meter house an enormous quantity of gas, which formed with the surrounding atmosphere an explosive mixture.

How was this mixture ignited? This is a question which cannot be answered. Was it by a match, by the cigarette of a smoker, or by a spark from the tool of a mason engaged in putting small blocks of stone beneath the mains? Was it by a burner alight in the laboratory, which is on the first floor of the building, and separated from the rest of it by a partition with a door; or by an electric lamp in use in the basement becoming accidentally broken? The writer of the report inclines to the first hypothesis; and he points out that on the ground floor of the building, in the vicinity of the station meter, there is a board on which there is a notification that smoking is strictly prohibited.

The explosion occurred in the subsoil of the building already referred to, and not only destroyed it entirely, but also did considerable damage to the adjoining purifier-house; and it was followed by a fire. The effect was that stones and bars of iron were projected in all directions, especially in that of the large gas-holder, of about 530,000 cubic feet capacity, which was close by, and which at the time was not quite two-thirds full. The side-sheets of the holder were perforated in several places, and as the escaping gas was ignited by the fire in the neighbouring building, the holder descended rapidly, got out of shape, and left the guide-framing. There was, however, no explosion, though the contrary was erroneously reported at the time.

The consequences of the accident were terrible. As mentioned at the outset, it caused the death of thirteen persons, one being M. Masset, the Manager of the Geneva branch of the Compagnie pour la Fabrication des Compteurs et Ma'ériel d'Usines à Gaz, of Paris, whose office was contiguous to the laboratory on the works; and among others were the Works Manager (M. Georges Béguet), the foreman, and an engineer who was on a visit, and who was engaged in conversation with a friend in the station-meter house at the time of the explosion. About twenty workmen, either belonging to the works or in the service of contractors engaged there, were more or less seriously injured. The damage done to the works was pretty considerable; but it was partly covered by insurance. Working had to be stopped after the accident; but it was resumed as soon as the most urgent of the repairs could be completed, and this was the evening of the 9th of September. At that date there was neither station meter nor governor available; but these were provided subsequently. With regard to storage, there was only one holder of about 130,000 cubic feet, and another of 166,000 cubic feet capacity, which were available; but, with the help of the carburetted water-gas plant, M. Des Gouttes was able to furnish sufficient gas to meet a daily consumption which exceeded 1¼ millions in December last. The damaged holder could not be brought into use until the 6th ult.; its repair having been difficult owing to the numerous holes and deformations found in it. The damage caused to the property in the neighbourhood of the works was estimated at about £4000. It consisted mainly of broken glass and damaged walls and roofs.

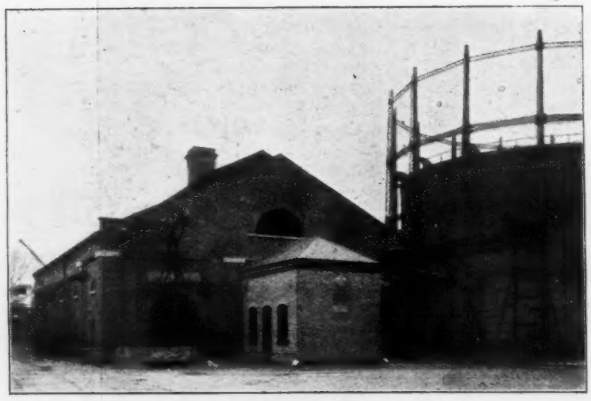
Suggested Use of Discs in Prepayment Meters.

There appeared a short time since in one of the Manchester papers a letter by Mr. J. D. Affleck, which contained the suggestion that discs should be used in prepayment meters, instead of pennies, with the idea of removing the temptation to rob. His idea was that shopkeepers should be employed, on a small commission, as agents for these discs, which would be purchased by the consumers as required. The main points of this letter appeared in the "JOURNAL" for the 1st ult. (p. 308); and now Mr. C. Jeffreys, of No. 735, Commercial Road, Limehouse, E., has drawn our attention to the fact that as long ago as January of last year he applied for a patent for a "token or device" to be used as a substitute for coin in prepayment meters. The discs made in accordance with the patent (which has since been sealed) are of what is known in the trade as "gilding metal," which is imported from the Continent, though the discs themselves are made in London. One advantage of using this metal is said to be that no marine store dealer will buy it. The discs are of exactly the right weight and size to pass through the slot and operate the gas-valve; and they are so notched at the edges as to prevent them being mistaken for pennies if placed in the pocket. On one side would be stamped the name of the undertaking to which they belonged; and fraudulent manufacture would be unlikely to occur, seeing that, as we understand, the tokens or tablets cost at least a penny each to produce. Mr. Jeffreys claims that there are many advantages to be derived from the use of the discs. Some of the ultimate benefits he states as follows: No loss of money; no cost of repairs and new padlocks; no cost of prosecutions; no tips to persons giving information as to robberies; and no cost of staff specially employed to catch thieves. The immediate gains foreshadowed include: No waiting for a month for the collection of money from meters—cash down, from all agents; more gas used than now, as people would upon pay day secure their supply of light for the ensuing week; and a more extended use of slot-meters in lock-up shops, &c.

Coal Output during Last Year.—A return has been issued from the Home Office containing an advance proof (subject to correction) of the tables relating to the output of coal and other minerals, and the number of persons employed at mines worked under the Coal and Metalliferous Mines Regulation Acts during the past year. The output of coal, which was 261,512,214 tons in 1908, was 263,758,562 tons in 1909; showing an increase of 2,246,348 tons. The number of persons employed was 1,013,998—an increase of 26,185.

MEETING THE GAS DEMANDS OF BROMLEY AND CRAYS.

Twin Generator Carburetted Water-Gas Plant—High-Pressure Plant and Mains to Supply the Crays District.



Front Elevation of the Old Retort-House before Alteration.

Old Retort-House after Raising the Walls and Roof.

THE absorption of the Crays Gas Company by the Bromley Gas Company, under the powers conferred by Parliament in the session of 1908, had as one of its purposes the production of manufacturing and business economies generally which, under the law of the sliding-scale, will eventually be advantageous alike to the consumers in the whole district and to the shareholders. In respect of manufacture, the fullest economy it was agreed by the Chairman (Mr. Alexander Dickson), the Directors, and the Chief Engineer (Mr. William Woodward) could only be obtained by plant concentration at Bromley, and the closing-down as a manufacturing station of the works of the defunct Crays Gas Company. The Bromley works, although quite capable of dealing with the requirements prior to the amalgamation, naturally needed some additions and alterations with the increased demands from the 15,000 acres added to the district of supply. The question of increasing the productive power of the works thus became a matter of practical politics.

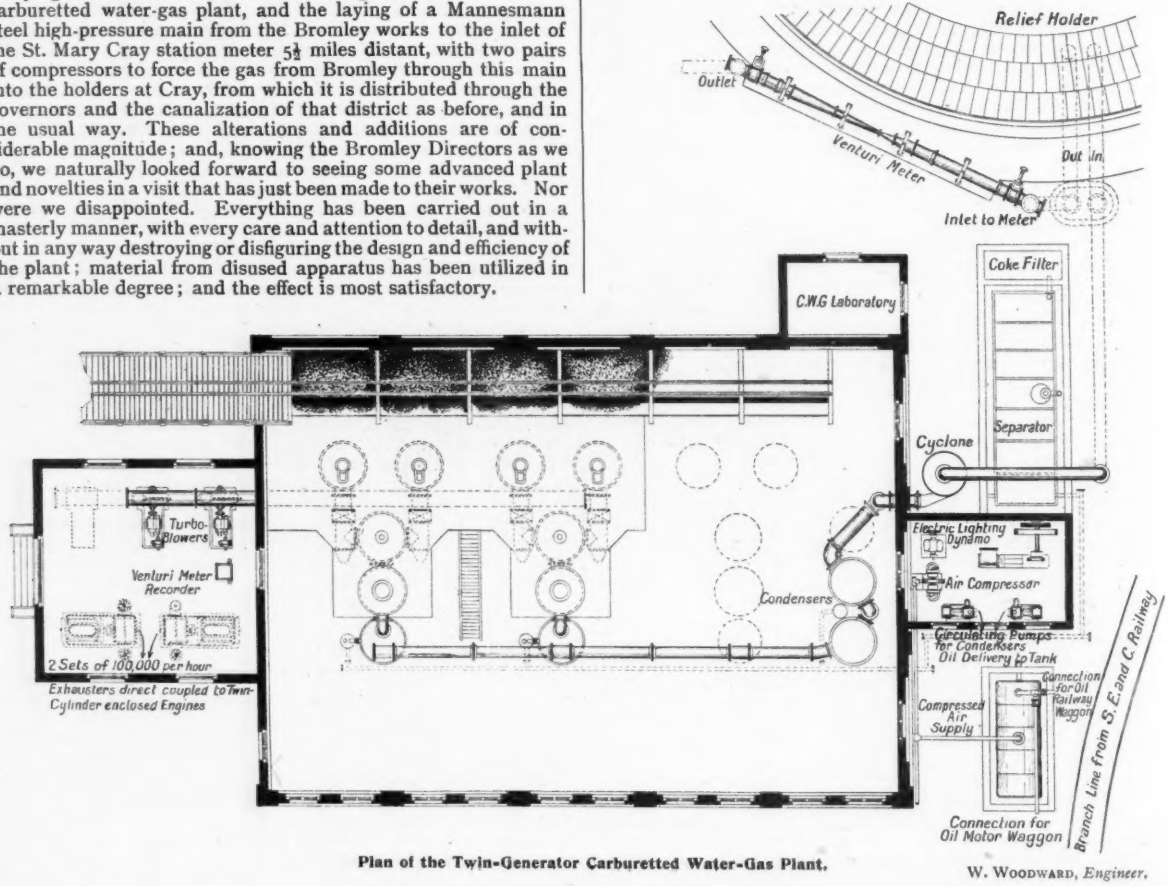
The Directors having, as before stated, determined that the whole of the gas required should be manufactured at Bromley, instructed Mr. Woodward to prepare a scheme and plans for carrying this into effect; the result being the installation of a carburetted water-gas plant, and the laying of a Mannesmann steel high-pressure main from the Bromley works to the inlet of the St. Mary Cray station meter 5½ miles distant, with two pairs of compressors to force the gas from Bromley through this main into the holders at Cray, from which it is distributed through the governors and the canalization of that district as before, and in the usual way. These alterations and additions are of considerable magnitude; and, knowing the Bromley Directors as we do, we naturally looked forward to seeing some advanced plant and novelties in a visit that has just been made to their works. Nor were we disappointed. Everything has been carried out in a masterly manner, with every care and attention to detail, and without in any way destroying or disfiguring the design and efficiency of the plant; material from disused apparatus has been utilized in a remarkable degree; and the effect is most satisfactory.

BUILDING CONVERSIONS.

There being on the works an old small coal-gas retort-house not well placed for coal delivery or in close proximity to the coal storage, and consequently little used, and only then when absolutely necessary, it was decided to dismantle this house, lift the roof, and convert the building into a proper home for the carburetted water-gas plant; an adjoining smaller oil-gas retort-house serving admirably, with alteration, for a machinery house—viz., for blowers, and exhausters when necessary. The carburetted water-gas house is 80 ft. long by 60 ft. wide. Before lifting the roof, it was very low; and it has been heightened to 34 feet at the eaves, which means that walls and roof have been raised by 14 feet. The building, formerly very squat and ugly, has, by this heightening, and judicious architectural designing, been now rendered into quite a pretentious structure, having a good exterior elevation, and being light, lofty, airy, and roomy inside—in fact, we should call it an ideal house altogether for the purpose to which it has been put.

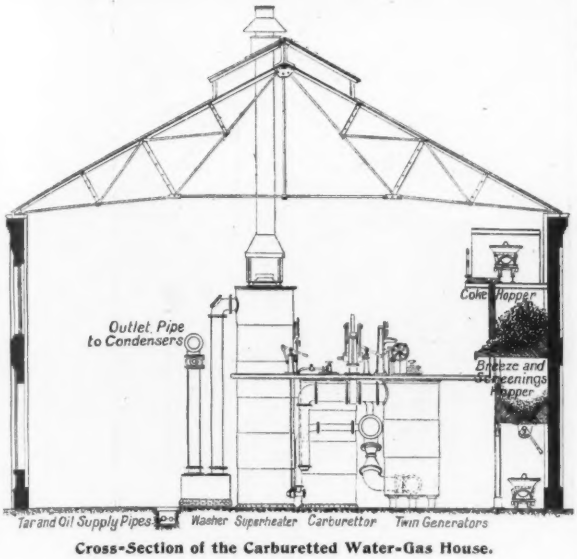
COKE SUPPLY TO THE TWIN WATER-GAS GENERATORS.

A special system of coke lifting and storing apparatus being in operation at Bromley, Mr. Woodward decided not to erect any



Plan of the Twin-Generator Carburetted Water-Gas Plant.

W. WOODWARD, *Engineer.*



Cross-Section of the Carburetted Water-Gas House.

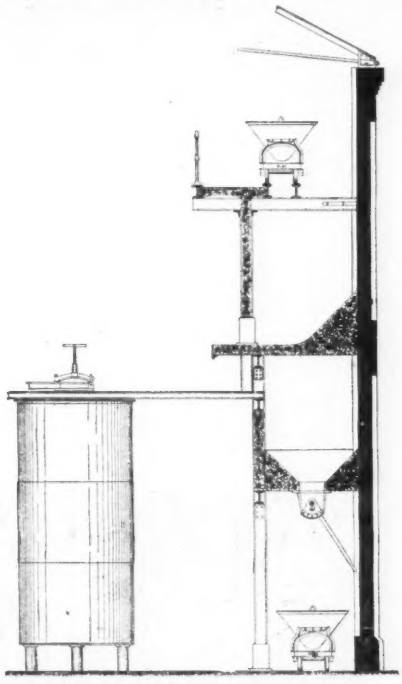
independent hoist or elevator for placing the necessary coke on the stage for supplying the water-gas generators; but an elevated gantry has been erected (and this out of disused material), with a large coke-hopper at one end, suitably placed for taking a supply from the special coke-loading machine in the yard. The gantry is constructed with rails, and runs from this point to and over the coke-hoppers inside the generator-house—the coke being conveyed thereon by special tip-waggons to the generator-house coke-hoppers. The gantry is formed of H-section steel standards (formerly buckstays to the old retort-beds). These are surrounded at the bottom by old 16-inch cast-iron pipes erected socket-down in concrete blocks; the pipes being then filled with concrete grout to the standards, and covered with small cast-iron caps at the top. These pipes make a splendid fender for the protection of the steel standards, shielding them from oxidation and damage from the surrounding coke, &c.; and they are of really very good appearance. The standards are properly braced together with channel steel, &c., and are surmounted with I-steel girders, which run from one to the other, and so on, into and over the coke-bins in the generator-house.

Inside the generator-house (as will be seen by the sectional drawing), the system of coke-bins is again somewhat novel. It will be noticed that they run the whole length of the house, and that they are in two heights, the upper one being for the coke supply, and the lower one for the screened breeze and brushings from off the operating-stage. The upper bin takes its supply of coke from the side-tipped coke-waggons. The floor of this bin is 3 feet above the operating-floor—one side being formed by the house wall, the other by iron standards and girders (again from the old retort-house) filled in with reinforced brickwork. There is an opening the full length for 18 inches above the bin-floor, through which the coke gravitates at an angle of about 40° on to the extended floor of the bin. The coke is then fed by coke-forks into the generator feeding buggies ready for charging. Mr. Woodward's idea in this is that, if the coke is observed and screened at its last stage, the possibility of dust and dirt being introduced into the generator is reduced to the lowest possible extent, and that better gas making, less clinkering of fires, and less possibility of blowing dust into and through the plant, is the result.

Under this upper bin and below the operating-stage level is another large bin also running the full length of the house, and formed as the one above—from reinforced brickwork and iron standards. But this bin is constructed with slide and swing doors at the bottom, by which its contents can be immediately emptied into carts or trolleys, as desired. The idea of this bottom or lower bin is to collect all the coke screenings taken from the upper bin in forking, and all the sweepings from the operating-stage. These are brushed into the bin from the level of the operating-floor. Consequently neither mess nor dirt is occasioned on the operating-floor or the clinkering-floor below; and the resultant breeze is stored and carted away as required, to the boilers or for sale, and is handled by the carters alone—there being no lifting into carts or trolleys.

The Carburetted Water-Gas Plant.

After fully considering the question with their Engineer, the Directors concluded that, for their special purpose, Messrs. Humphreys and Glasgow's twin-generator plant would be most suitable; and, to cut direct from inception to completion, there are in the house to-day two sets of the plant, each of a guaranteed producing capacity of 750,000 cubic feet a day, but capable, as test has proved, of yielding nearly 1 million cubic feet. The plant has been arranged to allow of the most ready and economical extension to a third section, which, if thought fit, may be larger and may be operated independently of, or together with, the other sets. The figures as to capacity require a word of explanation. Each of the present sections is capable in continuous work of producing in twenty-four hours 750,000 cubic feet when working in series; but, when working in parallel, each section is capable of yielding 850,000 cubic feet. Here we have the interesting fact that on this ground space, which contributed, under the old order of gas manufacture, some ½ million cubic feet to the output of the works, carburetted water-gas plant can find accommodation equal to an output of between 2½ and 3 million cubic feet per day. The plant, it is also interesting to note, has been designed so as to, at some future period, take advantage of the waste heat of the blast products from the generator and carburettor for the raising of steam in specially constructed boilers.

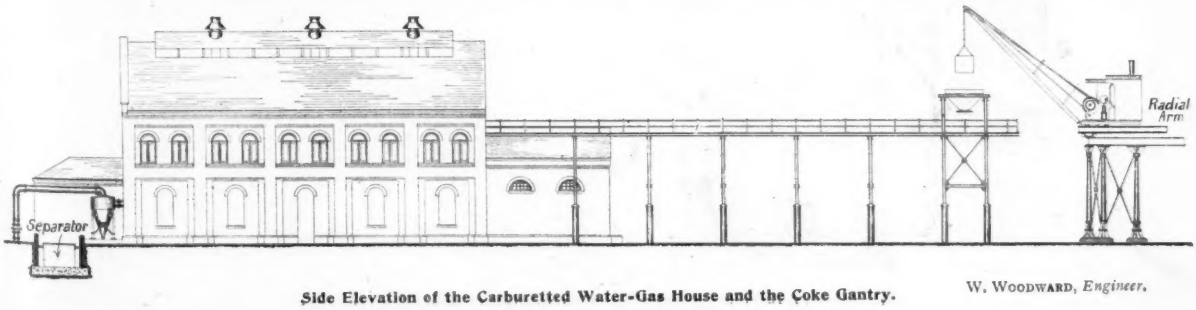


Section through the Coke and Breeze Hoppers.

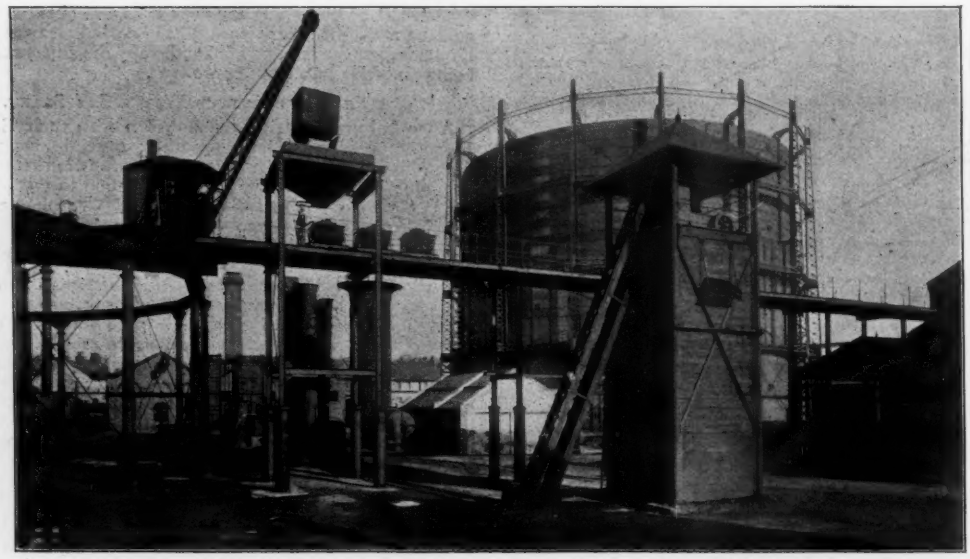
In the adjacent house (already referred to) are two sets of turbine blowers, together with the registering mechanism connected with quite a new application of a Venturi meter to gas making. It is a meter which gives a positive registration, and not merely an inferential one. These features, with the plant and the compressors for delivering gas through a new high-pressure main to the St. Mary Cray distributing holders, will be described after dealing with the water-gas plant proper.

Theory of the Twin Generator Plant.

We believe that this is the first entirely new twin-generator plant that Messrs. Humphreys and Glasgow have erected in this country, although they have converted to the system existing plants, and have also introduced the new type at Berlin, Vienna



Side Elevation of the Carburetted Water-Gas House and the Coke Gantry. W. Woodward, *Engineer.*

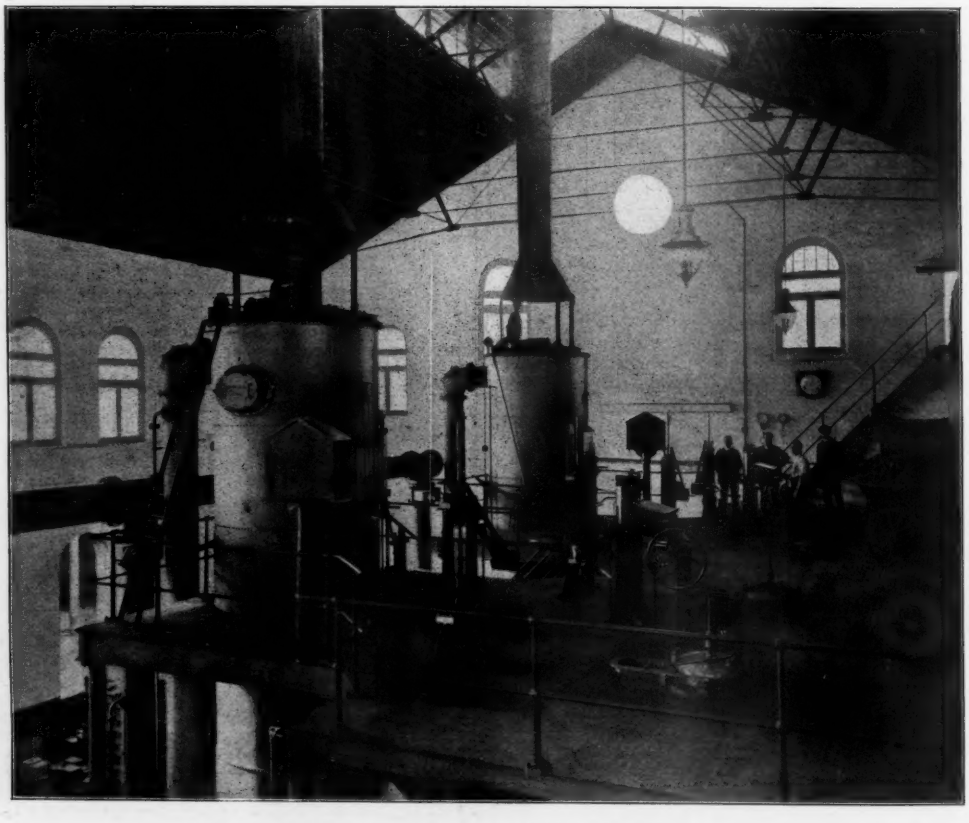


Special Coke Loading and Sorting Plant, Supplying Coke for the Carburetted Water-Gas House.

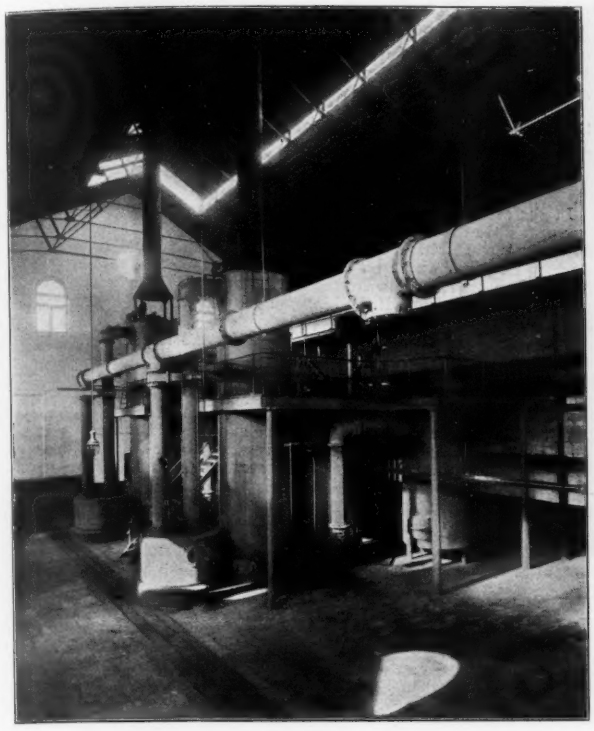
and other places on the Continent. It will be interesting to pause for a moment to consider the theory of this twin-generator plant. It is to be found in this simple explanation: The ends sought during the "run" and the "blow" in blue water-gas manufacture are antagonistic. In the "run" it is desired to produce no carbonic acid, while in the "blow" it is desired to produce no carbonic oxide. In practice, it is impossible to attain perfectly these opposite ends with one and the same fuel bed; and so practical working becomes a matter of compromise. The twin-generator system alters the distribution of the fuel bed for the "run" from that provided for the "blow." Two distinct generators are so connected together that the air-blast passes through them in parallel, whereas the steam passes through them in series in alternate direction. The maximum conversion of the oxygen of the steam to carbonic oxide is thus ensured by the passage of the steam in alternate direction through two zones of intense combustion, whereas the blast passes through but one such zone with practically no superlying reduction zones. Thus there is a minimum of carbonic acid in the water-gas and a minimum of carbonic oxide in the waste-blast gases. Several difficulties have been found in carrying out in practice the simple theory of the twin generators; but the working of the plant has shown strikingly that Messrs. Humphreys and Glasgow have overcome every practical difficulty and objection while preserving all the theoretical advantages of the system. For the economical manufacture of carburetted water-gas of medium or low grade, the plant is particularly serviceable; and its production, it is pointed out, can be considerably increased by making gas in parallel, which change can be instantly effected. Another advantage is that either generator can be put out of action without interfering with the other.

Details of the Twin-Generator Plant.

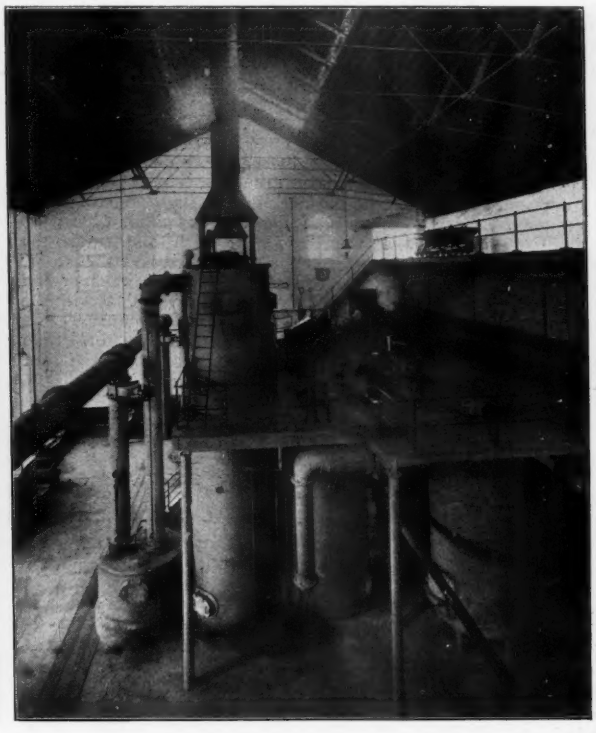
The foregoing brief indication of the principles of the twin-generator plant will attach greater interest to the description of the installation. As already mentioned, there are two units of the plant of the capacity previously specified—each unit consisting of twin generators, connected for blasting in parallel, and gas-making either in series (reversible) or in parallel. The lining (the wearable portion above the grate being arranged so as to be easily renewable) is of special double fire-block form, with thick non-conducting lagging between the lining and the shell. The generators, it is observed, are supported upon heavy cast-iron



Equipment of the Operating-Stage of the Carburetted Water-Gas House.



Interior of the Carburetted Water-Gas House, with Coke and Breeze Bins in the Rear.



Interior of the Carburetted Water-Gas House, showing the Twin Generators.

columns, affording ample space beneath for collecting and quenching refuse during clinkering. Each pair of generators is fitted with reverse-make apparatus, consisting of fire-brick lined hot-gas connections between the generators and the carburettor, controlled by interlocked valves. By means of this arrangement (in conjunction with which are the steam-distributing devices), gas-making is changed from parallel to series or *vice versâ* by one movement, without interference with the production of gas. Investigating the plant, it is apparent that safety in manipulation has been most carefully studied; for one finds a perfect system (Thuman's patent) of valve interlocking, by means of which all the valves—blast, stack, reverse-make, steam, oil, and vent—are so interlocked that it is impossible for them to be manipulated except in safe and proper relation, thus preventing mistakes on the part of the gas maker through inadvertence or ignorance. There are also found leakage vents and indicators, consisting of a system of piping in connection with the double-gate blast-valves, so that any possible leakage of gas or air past either face of the valves, when closed, is harmlessly discharged to the atmosphere, and its location indicated to the gas maker. This operating system is fully patented; and the explanations and details in regard to it that were afforded by Mr. Woodward on making an inspection of the plant were extremely interesting, both on account of the completeness of the system and the effectual achievement of object in every respect by the designed means. Before leaving the generators, it may be mentioned that there are dust-interceptors situated in the hot-gas connections between the generators and carburettors. The gases are deflected into the carburettor, while the particles of breeze and ash, by reason of their greater momentum, are projected into a collecting chamber, which is provided with a sub-discharging door.

Ascending to the operating-floor by the iron stairway (which floor is about 16 feet from the ground level), it is noted that it is spacious, and affords ample room for the operations. It is supported by the walls of the building and cast-iron columns, and is constructed of rolled iron checker plates, fastened to rolled steel joists by countersunk bolts. Though operations were in full progress at the time of the visit, everything looked spick-and-span on this floor. The compactness of the plant, and the completeness of the arrangements for operating, regulating, and controlling it in every detail, by air blast and steam meters, pyrometers, and gauges of various kinds, were points that could not fail to be observed. For instance, it was noted that the recording desks are attached to the steam and oil standards, where the gas makers are in constant view of the meters, gauges, &c., and in convenient reach of all operating gear. But to return to the main part of the plant. There are the carburettors and superheaters, one set to each pair of generators. They are of cylindrical form, and are lined with heavy fire-blocks and thick non-conducting lagging, and filled with special fire-brick checker-work. The oil-distributor is of the centrifugal type. The superheaters are fitted with self-sealing gas-outlets and stack-valves, the latter worked from the operating-floor by interlocked gear. The smoke-stacks are supported by legs on the top of the superheaters, and project through the roof of the house.

Following the course of the gas, the gas take-off connections between the superheaters and the washers are water-sealed, and are provided with convenient openings for cleaning. There is nothing special to note about the washers; but it is next observed that scrubbers have been omitted, and jet-condensing arrangements substituted. There are also two multitubular water-cooled surface condensers, of extra large capacity, connected for use in series, and containing together 6760 square feet of cooling surface, with 22 square feet area of gas-way. Goose-neck gas and water connections between the condensers, compel the gas to travel throughout in the reverse direction to the current of cooling water. On top of the condensers service-tanks are formed, by means of which the hot effluent condensing water is made available for boiler feed if desired. By 20 inch connections from the condensers, the gas passes to one of Dr. Colman's "Cyclone" centrifugal tar-extractors, of 1½ million cubic feet capacity, to assist in removing the condensation from the crude gas before it enters the relief holder. This "Cyclone" separator is situated outside the house; and hard by is the tar-separator, which is 30 feet by 8 feet by 6 feet deep, and built of steel plates. In the

Interior of the Blower House, showing also the Venturi Meter Recorder.

bottom of the separator is a cast-iron sump, in which the tar collects, and from which it flows automatically and continuously through an ascension-pipe and adjustable overflow. A safety-valve in the tar-outlet connection automatically closes should any unexpected disturbance cause the water to break through the tar-overflow.

After leaving the centrifugal tar-extractor, the gas passes through 24-inch pipes into the relief holder, which is 100 feet in diameter; and from thence it is drawn in a constant stream through a Venturi meter of 100,000 cubic feet per hour capacity into the ordinary foul main of the coal-gas plant, where the mixture takes place. It then travels through the plant in the ordinary way with the coal gas to the holders, and thence for distribution—the exhausters, condensers, scrubbers, washers, and purifiers being for the present of ample capacity to deal with the extra quantity. But everything is designed and prepared for the easy addition of special exhausters, purifiers, &c., when the time arrives at which the coal gas produced will absorb all the power of the existing exhausters, &c.

(To be continued.)

NEW GAS-WORKS AT CARDENDEN.

Description of the Plant.

On Monday last week, the formal opening ceremony took place in connection with the recently erected gas-works at Cardenden, Fifeshire, in accordance with plans prepared by Mr. J. B. Scott, the Engineer and Manager of the Cowdenbeath Gas Company.

The works are situated in a hollow beside the railway, but at too low a level for getting railway lines into them. This, however, is of little moment, as nearly all the coal required is carted direct from the pits, the cost of cartage being 6d. or 7d. per ton. The site of the works is a slope, which makes it easy to handle the materials. The retort-house—a brick structure—is 48 ft. by 40 ft., and contains a bench of three ovens, two of which have been brought into use—one with a setting of six, and the other of four retorts. They are built on Brown's principle, with his patent conduit regenerators; the bench having been erected by Messrs. James Brown and Co., of Hamilton. The retort-house furnishings were supplied by Messrs. R. Dempster and Sons, Limited, of Elland; the contract including their patent self-sealing mouthpieces, a travelling platform (the design of Mr. F. Scott, of Galashiels) in front of the bench, and a tar-column. The retort-house is built against a retaining boundary wall; and in this way provision is made possible for the shooting of the coal direct from carts on the public roadway into the store. Under the same roof are the boiler, pump, and engine houses, workshop, and exhauster-house, in the latter of which there is a steam-driven exhauster of 7500 cubic feet capacity, supplied by the Bryan Donkin Company, of Chesterfield.

The gas passes through a water-tube condenser, a two-brush Creeke annular scrubber and washer, and three purifiers, 10 feet square, with dry luting, all supplied by Messrs. Henry Balfour and Co., Limited, of Leven, who also erected a 60,000 cubic feet gasholder. This is in a steel tank, and the lift is spiral-guided, on the Gadd and Mason principle. A station meter, of a capacity of 8000 cubic feet per hour, was supplied by Messrs. Alder and Mackay, of Edinburgh; and the station governor is by Messrs. Peebles and Co., Limited, of Edinburgh.

The works are capable of producing 20 million cubic feet of gas per annum; and they have been erected at a cost of a little under £4000. Gas has been supplied from them since last October, when Mr. W. Brown, of Lasswade, was appointed Manager. The output during the winter has been nearly 2 million cubic feet.

Opening Ceremony.

The inaugural ceremony consisted of fully opening the outlet-valve from the gasholder, which had been half closed for the occasion.

Mr. J. B. Scott welcomed the visitors, on behalf of the Directors of the Company, and introduced Mrs. R. A. Muir, the wife of the Chairman, who had been invited to formally open the works.

Mrs. Muir, working a specially made aluminium wheel, bearing an inscription, opened the valve. She expressed the pleasure she had in being there, and her thanks to the Directors of the Company for honouring her with the request to perform the ceremony. The one thing that was needed to put the village on an equality with other places had now been provided; and she hoped the gas-works would have every prosperity.

Mr. J. Barker, on behalf of the Contractors, presented Mrs. Muir with the aluminium wheel.

Mr. R. Muir, speaking for his wife, returned thanks for the gift. He expressed his pleasure in saying that nearly the whole of the shares in the Company had been taken up by the inhabitants of the district.

Lunch was afterwards served in the "Gothenburg," to a company numbering about sixty.

Mr. J. Hutton (Edinburgh) proposed "The Gas Company," and in doing so said the thanks of the whole community were due to those who had brought the gas undertaking to the stage which it had now reached. The Company had already six miles of mains laid and 800 meters in use. The works were very complete, and equal to producing a large output of gas. They had been well engineered; and he thought they could all see that the Manager appointed was a capable one.

Mr. Muir, in responding, said that on account of the rapid rise of the district they were obliged to put light of some sort into it. Different kinds were proposed; but they always came back to gas lighting. One of the lessons they learnt was that coal gas could hold its own, on a commercial and an effective basis, with any other illuminant which it was proposed to introduce; and he thought they had been very well advised in putting down gas-works.

Mr. A. C. Taylor (Glasgow), representative of Messrs. Falk, Stadelmann, and Co., Limited, proposed "Gas Managers," and Mr. J. Dickson (Kelty) responded.

Gas Exhibition.

In the evening an exhibition of gas-stoves and lighting appliances was opened in the hall attached to the "Gothenburg." Mrs. Muir, in declaring the exhibition open, said she trusted that the lectures which were to be given would be taken advantage of by the women of the place, who were largely interested in cooking.

On the motion of Mr. R. B. Main, of Glasgow, a vote of thanks was accorded to Mrs. Muir.

The exhibition was open during the week, and lectures were given twice daily by Miss E. M. Dodds, of Dundee.

The exhibits included Messrs. Alder and Mackay's automatic lighting apparatus, also a prepayment meter in glass; an extensive range of gas-fittings and accessories in lighting schemes, by Messrs. Falk, Stadelmann, and Co., Limited, who had a brilliantly lighted stand; and a large dislay of cooking-stoves and gas-fires, by Messrs. R. & A. Main, Limited. Among the exhibits of the last-named firm was the "St. Nicholas" gas-fire, in which black fuel is used; and the appearance is exactly like that of a glowing coal-fire.

COMPLETION OF THE VYRNWY WATER-WORKS.

Outline of the Scheme.

Last Wednesday, His Royal Highness the Prince of Wales performed the ceremony of marking the completion of the Vyrnwy scheme for the supply of Liverpool with water. The history of this great undertaking is known to most of the readers of the "Journal" who are interested in water supply; but it may be again briefly recounted.

Parliamentary powers for carrying out the scheme were obtained by the Liverpool Corporation in 1880; and the first stage of the work—comprising the damming of the Vale of Vyrnwy, the impounding of the river and its tributaries, and the construction of 68 miles of aqueduct to the distributing reservoirs at Prescot, a few miles from Liverpool—was completed in 1892, under the supervision of Mr. Thomas Hawksley and Mr. George F. Deacon, neither of whom lived to witness last Wednesday's ceremony. Two years later, the present Corporation Water Engineer (Mr. Joseph Parry, M.Inst.C.E.) was instructed to report on the second part of the scheme, consisting of the impounding of the waters of the Cowny and the Marchnant, on the south-west and east respectively of the Vyrnwy valley. After making two reports, he was authorized to proceed with the working drawings; and these and the specifications were submitted in the autumn of 1896.

The Cowny works were commenced early in 1898. The tunnel conveying the water to the Vyrnwy reservoir is 6453 feet long and 7 feet diameter; and it was designed for a maximum discharge of 120 million gallons per day. It cost £19,050; that of the dam and culvert being £3655—making together £22,705. The watershed of the Cowny, above the point of diversion, was estimated to yield, in periods of dry years, rather more than 7 million gallons a day on an average. On the completion of the Cowny works, those for the diversion of the Marchnant were proceeded with. The tunnel is 7345 feet long and 7 feet in diameter; and it was designed for a maximum flood discharge of 88 million gallons daily. It was begun at the inlet heading in January, 1902, and at the outlet heading a year later. Work was suspended for a time; but the headings met early on the morning of April 6, 1908. The tunnel discharges on the north-east bank of the lake. The total cost of the Marchnant works was £18,900.

To convey the water to Liverpool required great resource and much labour. The lake is shut in by hills rising to 1600 or 1700 feet; and the preliminary task was to get the water through them. Accordingly, from the south-easterly corner of the lake they were tunnelled with a shaft 2¼ miles long, driven in great part through the solid rock to Hirnant, where the 68 miles of aqueduct already referred to begin to run across the country to Prescot, where, in the large reservoirs, the waters from Vyrnwy and Rivington are mixed and sent on through three pipe-lines to Liverpool. On the way from Vyrnwy the water is filtered at Oswestry; and the aqueduct is tapped at many points along its course to supply various towns and villages. Very ingenious and interesting is the way in which the Hirnant tunnel receives the water from the lake. The outlet is at the handsome tower standing three-quarters of a mile from the foot of the lake on its north-east side. The water is drawn from the lake through two columns of 36-inch diameter steel tubes, housed in the tower, and at the bottom there are three openings connected with the aqueduct, controlled by throttle-valves, and covered by cylindrical screens or strainers of fine copper wire gauze. From these, starts the first section of the aqueduct, consisting of 730 yards of concrete culvert, circular in section and 4 feet in diameter, built in the valley bottom, and leading to the tunnel. The aqueduct proper is 7 feet in diameter, made of cast-iron pipes in 12-feet sections, jointed with lead and yarn. There are now two lines of pipe—a second one having been begun in 1902 and completed in 1905.

Easements were obtained by the Corporation for three pipe-lines; but it is not anticipated that the third line will be required for some years.

It has already been mentioned that the Engineers for the first stage of the work now brought to a successful conclusion were Messrs. Hawksley and Deacon; the latter being the Borough Water Engineer, and the former the distinguished Engineer whose name and that of his son and successor are associated with so many water undertakings. On Mr. Deacon relinquishing his position, he was succeeded by his Assistant, Mr. Parry, who has been solely responsible for the diversions of the Cowny and Marchnant and the laying of the second pipe-line. To the combined skill of these gentlemen, Liverpool owes its present magnificent water-works, which have been carried out without marring the natural beauty of the valley in which they are situated, but rather adding to it, and have evoked the admiration of visitors from all parts of the world. The extensions above described complete the whole of the impounding works authorized by Parliament at Lake Vyrnwy, and bring up to £2,936,182 the total expenditure on the scheme. The additional water available for Liverpool daily by the Cowny and Marchnant diversions is, in round numbers, 10 million gallons; and the total dry-weather yield of the three watersheds is about 60 million gallons per day.

Opening Ceremony.

To perform the opening ceremony, His Royal Highness the Prince of Wales travelled from Euston by special train to Four Crosses, in Montgomeryshire, which was reached just before two o'clock. Here he was received by the Lord Mayor of Liverpool (Alderman W. H. Williams), the Lord Lieutenant of the county (Sir Herbert Lloyd Watkin Williams-Wynn), and several official personages, including the Assistant Water Engineer of the Corporation (Mr. J. R. Davidson). His Royal Highness and the company then proceeded by motor cars to Llanfyllin, where he received an address of welcome. A move was then made to Vyrnwy, where, among others, the Chairman and Deputy-Chairman of the Water Committee (Lieut.-Col. Porter and Major Denton), the late Chairman (Mr. W. J. Burgess), and the Water Engineer (Mr. Parry) had the honour of being presented.

The company having taken up their positions, the Mayor read an address of welcome, in the course of which some particulars were given of the extent of the Vyrnwy scheme, the cost of which, from the commencement, had been nearly £3,000,000. The work had, however, it was stated, been carried out so economically, on the advice of expert and competent engineers, that the Corporation were able to supply water at a very reasonable rate. They considered that great credit was due to the original promoters of the scheme, and to the respective Water Committees and their Engineers, who had been responsible for the management and progress of the work.

In the course of his reply, His Royal Highness expressed his great pleasure in performing the crowning act of a vast scheme for providing an adequate water supply, the completion of which had occupied upwards of 29 years. The short description the Mayor had read of the inception and carrying out of this immense undertaking was a record of engineering science and a monument of municipal enterprise. They could see for themselves how the genius of man had transformed the valley of a mountain stream and its tributaries into a lake of more than 1000 acres, capable of yielding between 50 and 60 million gallons of water a day through an aqueduct nearly 70 miles in length, and supplying not only Liverpool, but many other districts with that inestimable blessing, abundance of pure water; and the work had been carried out not only efficiently but economically, so that this boon was obtained at a moderate cost. They would all, he knew, join with him in paying tribute to those who were the original promoters of the scheme—to the Engineers who designed and executed the work, not forgetting the men of mind and muscle, to whose labours this magnificent undertaking was a striking testimony; and he congratulated the city on having secured for many years to come an ample provision from that beautiful Welsh watershed. He added: "You have asked me to turn on to-day into this great lake the water which you have collected from the Marchnant River—a large and important addition to the scheme, the carrying out of which is due to your trusted Engineer-in-Chief. I shall do so with the greatest pleasure and with every good wish."

The next stage in the programme was the unveiling of the memorial tablet, which was affixed to a wall immediately over the Royal stand. It was surmounted with flags emblematical of Liverpool and Wales. At the request of the Lord Mayor, His Royal Highness unloosened, amid cheers, the temporary covering of the tablet, on which was the following inscription:

> Corporation of Liverpool. This tablet was unveiled on the 16th March, 1910, by His Royal Highness the Prince of Wales, to celebrate the completion of the works authorized by Parliament for taking and impounding the waters of the Rivers Vyrnwy, Marchnant, and Afon Cowny. William Humphrey Williams, Lord Mayor; Robert Stephen Porter, Chairman of the Water Committee; William Denton, Deputy-Chairman. The Vyrnwy Reservoir was completed and the first instalment of water delivered into Liverpool 14th July, 1892. A second instalment was delivered 16th October, 1905. Joseph Parry, Engineer, 1890-1910. Edward R. Pickmere, Town Clerk.

Following upon this, the Llanfyllin Choir sang "God Bless the Prince of Wales."

At the close of the initial ceremony, the Prince, with the Lord Mayor, the Lady Mayoress, and the other members of the party, walked a short distance along the fine highway which encircles the reservoir to the point at which the Marchnant tunnel emerges into the lake, where stands and enclosures had been erected. On the principal stand, placed close to the mouth of the tunnel, there was a handsome gilt lever connected with the gates of the conduit, which were closed. Mr. Parry handed to the Lord Mayor a solid silver casket, the immediate purpose of which was to contain the handle of the lever, but it would also serve as a handsome cigar and cigarette box. On the top were the Prince of Wales's Feathers in enamel; on the back an enamel view of Lake Vyrnwy; and on the front a liver, together with the following inscription: "Presented to His Royal Highness the Prince of Wales, by the Corporation of Liverpool, at the ceremony of the completion of the Water-Works at Lake Vyrnwy, 16th March, 1910." This was handed to His Royal Highness with a formal request by the Lord Mayor that he would accept it, and would turn on the water. The Engineers then screwed the handle on to the lever; and the Prince pulled the latter over, and promptly the sluice-gates opened, and the waters of the lake boiled as the pent-up flood of the Marchnant burst through the tunnel.

The last act of the great enterprise was complete, and another 5 or 6 million gallons of water per day were added to Liverpool's store in Lake Vyrnwy. The daily available volume of pure water from the reservoir was raised to its maximum of 60 or 70 million gallons; and the total watershed tapped to 22,742 acres. As the flood poured from the tunnel there was a hearty cheer from the assembled company.

The Prince subsequently examined with interest a number of photographs of the Vyrnwy works that were submitted to him by the Water Engineer. A pleasing feature of the ceremony was the presentation to the Prince, by Mr. Parry, of Mr. H. N. Giles, the Resident Engineer at the Marchnant works; Mr. Samuel Glossop, the inspector; Mr. David Ricketts, stonemason; and Mr. Samuel Dalzell, miner, who had been connected with the work since its inception.

Following this was a semi-private visit by His Royal Highness to the tower into which the water of the lake is drawn and strained before it is sent out through the great tunnel. He motored out to the handsome structure with Lieut.-Col. Porter, Mr. Parry, Lord Derby, the Hon. Derek Keppel (the Equerry-in-Waiting), and the Lord Mayor. The Prince was greatly interested in the methods by which the water is brought out of the reservoir and strained before being sent through the Hirnant tunnel and some miles of aqueduct to the sand filter-beds at Oswestry. Before leaving, His Highness planted a young oak as a commemoration tree. While he was at the tower, members of the Corporation visited the works below the dam, under the direction of the Assistant Water Engineer (Mr. T. Duncanson). A feature of the works is the compensation water-house, which regulates the supply of water given, under the terms of the Act of Parliament, to the River Vyrnwy.

At the conclusion of the ceremonies, His Royal Highness motored to the Lake Vyrnwy Hotel, where he partook of tea. He left about half-past four, with Lord Derby, for Huyton, on his way to Knowsley.

An Interesting Reminiscence.

The completion of the Vyrnwy scheme was the subject of a leading article in "The Times" on Thursday. In the course of it the writer made the following remarks:

The benefits of this undertaking are not confined to Liverpool alone. When the authorizing Act was passed in 1880, it contained a clause empowering the Liverpool authorities to supply water, by agreement, to any place situated within 20 miles of the line of the aqueduct; and advantage has been taken of this arrangement in no fewer than 33 instances, representing a population of over 100,000. The presence of the Prince of Wales at Lake Vyrnwy was particularly appropriate, for it was largely through the action of his father that this result has been rendered possible. In 1878, the King wrote a letter to the Chairman of the Society of Arts, in which he called attention to the fact that, while great cities like Manchester, Liverpool, and Birmingham were taking steps to obtain improved supplies of water, the smaller towns and villages were dependent on accidental sources, which in many instances were wholly inadequate for health and comfort; and he suggested that a conference should be called together for the consideration of this question. The conference was duly held, under the chairmanship of Sir Henry Cole, and its influence was quickly exhibited; for in the Thirlmere Act, obtained by Manchester in 1879, Parliament inserted a provision enabling any local authority in the vicinity of the aqueduct to demand a supply on certain specified terms. As a matter of fact, this compulsory arrangement has not proved so useful as the permissive one adopted in the case of Liverpool; and few places between Thirlmere and Manchester derive their water from the aqueduct.

Another matter to which the King invited consideration was the question how far the great natural resources of the country might, by some large and comprehensive scheme, be turned to account for the benefit, not merely of a few large centres of population, but of the general body of the nation. Apart from the instances just mentioned and a few others of a similar kind, it cannot be said that we have made much progress in this direction. We still permit large towns to take possession of gathering-grounds in Wales and elsewhere for their own uses, without much regard for the actual or potential needs of other places not less important; and, in spite of resolutions by the Metropolitan Water Board urging that Parliament should regulate the appropriation of water-supplying areas with due consideration for the requirements of London and other populous districts, the business of water supply continues to be conducted on a parochial rather than a national basis.

The offices of the Provincial Water Companies' Association (Mr. R. Leslie S. Badham, Secretary) were on Thursday last removed from Victoria Street to Palace Chambers, Bridge Street, Westminster.

A pumping-engine test made at the North Point station of the Milwaukee Water-Works affords an indication of the progress made in the design of this kind of machinery. The engine tested was a vertical triple-expansion crank-and-flywheel pump, with a rating of 12 million gallons per 24 hours, against a head of 275 feet. With steam at 125 lbs. pressure, it was guaranteed to give a duty of 165 million foot-pounds. In 1892, the Allis-Chalmers Company installed an engine in this station which gave an unprecedented duty of 154 million foot-pounds. The new engine furnished by the same builders developed during a continuous 24-hour run a duty of 175·4 million foot-pounds per 1000 lbs. of steam.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Lecture by Dr. Harold G. Colman.

A Meeting of the London and Southern District Junior Gas Association was held at the Cripplegate Institute last Friday evening—Mr. W. J. LIBERTY, the President, in the chair—when Dr. Harold G. Colman (who on rising was warmly greeted) delivered the first of two promised lectures; the second being due early next session. A crowded audience, which included a number of visitors (some of whom spoke in the subsequent discussion), listened attentively to the lecture, and watched carefully the practical demonstrations by which it was accompanied. Previous to the event of the evening, it may be remarked, those present were afforded a welcome opportunity of an informal chat over a cup of coffee.

Dr. COLMAN's lecture was as follows :—

THE DEVELOPMENT OF HIGH TEMPERATURES BY GASEOUS COMBUSTION.

After your Committee had kindly asked me to give a lecture at one of your meetings this session, I was for some time puzzled as to the choice of a subject, inasmuch as in this Association, although all the members are connected with the gas industry, some are chiefly concerned with the manufacturing department, while others are mainly occupied with the distribution and sale of the gas produced by their colleagues, and its employment by consumers in the best practicable manner. On consideration, however, it seemed to me that the subject of gaseous combustion was of primary importance to all of you, and that it might be advantageous to spend the time in considering, in the first place, the principles of the development of high temperatures by combustion, and, in the second, to discuss the bearing of these principles in connection especially with two practical applications of gaseous heating—namely, the heating of retort-settings by gaseous firing, and the heating of incandescent mantles; the former being of great importance in the manufacture, and the latter in the consumption, of the gas. I soon found, however, that it would not be possible to deal with both parts of the subject in a single lecture; and your Committee therefore agreed to my dividing it into two—the first part to-night, dealing with the more theoretical part, and the second, to be given next session, taking up the considerations of the practical applications.

In discussing the changes which take place when a gas burns with production of a flame, it will be easiest, in the first instance, to confine our attention to one of the simplest cases, taking as an example the combustion of the gases hydrogen and oxygen. When a jet of hydrogen burns in pure oxygen, it produces a flame which is only slightly luminous, but has a very high temperature; and in the flame the hydrogen and oxygen combine together to form water, which at the high temperature existing in the flame is, of course, present in the form of steam—*i.e.*, as a gas. It is well known to you that the combination of hydrogen and oxygen always takes place in exactly the same proportions—2 volumes of hydrogen combining with 1 volume of oxygen, yielding 2 volumes of steam, or 1 part by weight of hydrogen combining with 8 parts by weight of oxygen to form 9 parts by weight of steam, which, of course, if condensed, gives exactly the same weight of water. But, in addition, the total amount of heat produced by the combustion of a given quantity of hydrogen is also constant, and may be expressed quantitatively, if we fix on a certain quantity of heat to be employed as a unit. In this country, the unit of heat is the British thermal unit, which is the quantity of heat required to raise 1 lb. of water 1° Fahr.; but for the purposes of this lecture it is much more convenient to use the metrical system unit—namely, the quantity of heat required to raise 1 gramme of water 1° C., known as the smaller calorie, distinguished by using a small initial letter from the larger Calorie, always spelled with a capital "C," which represents the amount of heat required to raise 1 kilogramme of water 1° C., and is therefore 1000 times as great as the smaller calorie.

By direct experiment with the calorimeter, it has been found that 1 gramme of hydrogen, when burned in oxygen to form water, gives off sufficient heat to raise 34,170 grammes of water 1° C., or, put in other words, the calorific power is 34,170 calories per gramme. In making such determinations of calorific power, the whole of the steam produced by the combustion of the hydrogen is condensed to water in the calorimeter, so that the heat given out by the steam in condensing to water is also included in the above figure for calorific power, which is therefore known as the gross calorific power. In the actual flame, the water formed is always present as vapour; so that this heat due to the condensation of the steam is never evolved, and therefore for the purposes of high temperature production cannot possibly be utilized, and must be allowed for. It has been found by direct experiment that each gramme of steam at the boiling-point gives off 537 calories. In condensing to water at the boiling-point, this being the latent heat of steam, and as there are 9 grammes of water produced from each gramme of hydrogen, we must deduct $9 \times 537 = 4833$ calories from the above gross value, giving a calorific power of 29,337 calories for each gramme of hydrogen, when the water produced remains in the form of steam—this being known as the net calorific power.

Now, while it is true, as stated, that a constant quantity of heat is always evolved when a definite volume or weight of a combustible gas is burned in oxygen, it is by no means true that the same temperature is always obtained; for the terms "total heat" and "temperature" are not equivalent to each other. Thus, for example, if we heat 100 grammes of water from 10° to 50° C., and 200 grammes from 10° to 30°, the amount of heat added is the same in both cases—namely, 4000 calories; but the temperature of the water has been increased twice as much in the first case as in the second. For an approximate analogy, we may take heat and temperature as having the same relation to each other as the weight and pressure or head of a volume of water. The pressure of a column of water, though due to and directly connected with its weight, is not dependent on the total weight, but on the height of the column above the point at which the pressure is taken; and, similarly, in a body at high temperature, the heat in it, though it may be small in total amount, may be regarded as being at "high pressure."

Now in the industrial application of gaseous fuel, the object is in most cases to obtain a high temperature; so let us next examine the question of the highest possible temperatures which could be obtained under ideal conditions by burning a combustible gas, still using hydrogen as an example. We have seen that 1 gramme of the latter, in burning to oxygen, yields 9 grammes of steam, and evolves sufficient heat to raise 29,337 grammes of water 1° C. As there are only 9 grammes of steam in the flame itself, the temperature of this amount would be raised $\frac{29,337}{9} = 3260°$ C., if the same amount of heat was required to heat 1 gramme of steam and water 1° C. As a matter of fact, however, it is found that much less heat is required to raise the temperature of steam than that of the same weight of water. Up to temperatures of 200°, the amount of heat required to raise 1 gramme of steam 1° C. is only 0·480 that required to raise the same weight of water 1° C. This ratio of the quantity of heat required to heat any substance 1°, to that required to heat the same weight of water by a similar amount, is known as the specific heat of the substance. It is obvious that, if steam requires less heat to raise its temperature than water, the same quantity of heat will raise a given weight of steam to a proportionately higher temperature than the same weight of water; so that our 9 grammes of steam would be raised by the action of 29,337 cal. to a temperature of $\frac{29,337}{9 \times 0·48} = 6790°$ C. or 12,254° Fahr. This, therefore, is the highest possible temperature which we could expect to obtain by the combustion of hydrogen under ideal conditions; and we may refer to this as the "ideal" flame temperature of hydrogen.

In calculating this temperature we have assumed certain conditions—namely (1) that the specific heat of the steam remains the same at the high temperature of the flame as it is at 200° C.; (2) that nothing whatever is heated in the flame but the steam formed by the combustion of the hydrogen; (3) that no heat escapes from the flame by conduction or radiation, but that the whole of it is used in the flame to raise the temperature of the flame gases. In practice, none of these three conditions is in reality fulfilled; and, in consequence, the actual temperatures obtained in practice, both with hydrogen and other combustible gases, invariably fall very far below those calculated in the above manner.

With regard to the first point, it has now been shown beyond doubt that the specific heat of gases does materially increase as the temperature increases—that is to say, that at high temperatures more heat is required to increase the temperature of a gas 1° than is the case at lower temperatures. This is very marked with steam and carbonic acid, which are the chief products of combustion from the common combustible gases. The elementary gases also have the same property; but the rate of increase of the specific heat is much smaller. The experimental difficulties in obtaining an accurate determination of the specific heat of gases at high temperatures are very great, and have not been yet altogether overcome. But it seems most likely that in the case of steam, for example, whereas the specific heat at 200° is about 0·48, the average specific heat at temperatures from 0-1400° C. is the much higher figure of 0·532. This supplies at once one reason why the flame of hydrogen cannot reach the temperature calculated above.

The second of the above conditions is also never fulfilled in practice. Even when a jet of hydrogen is burning in pure oxygen, it is necessary that a slight excess of oxygen should be present in the flame if the whole of the hydrogen is to combine with the oxygen and liberate the whole of its heat of chemical combination in the flame; and this excess of oxygen must also be heated up along with the steam, thereby further reducing the temperature. A very much larger reduction is brought about in the great majority of cases in practice, owing to the fact that the gas burns in air instead of in pure oxygen; so that then, taking our example of hydrogen, the heat evolved has to raise the temperature not only of the steam and excess of oxygen, but also of a large amount of nitrogen, amounting to four times the volume of the oxygen used.

If we now calculate the temperature of a hydrogen flame burning in air, and getting into the flame (say) 2 per cent. more air than the theoretical, and use the most probable values of the specific heats of the gases nitrogen, oxygen, and steam at high temperatures, we find that the highest temperature we could expect to obtain would be 2560° C., or 4640° Fahr.—a very much lower temperature than the ideal one previously given for hydrogen

burning in oxygen. Even this temperature is still much higher than we can actually obtain by burning hydrogen or any gas we know in air; and the reason is that the third assumption made can never be fulfilled in practice—heat being always lost from the flame either by radiation or conduction to the surrounding gas which is not actually taking part in the combustion.

The extent to which highly heated gases such as are present in a flame lose heat by radiation, is a matter about which but little is yet definitely known; although it is certain that the extent of the radiation from hot gases is very much less than that taking place from solid bodies heated to the same temperature. It is, however, estimated by Professor Callendar that in an ordinary bunsen flame about 15 per cent. of the total heat is not utilized in the flame, but is lost by radiation, &c.

Whatever may eventually be found to be the exact amount of such radiation, so long as it exists at all it is evident that it must result in the removal of heat from the flame, so that less of this energy is present to raise the products of combustion to a high temperature; and it further follows that the greater the time that elapses before the complete union of the combustible particles and the oxygen molecules takes place, the higher will be the proportion of heat lost in this manner, and consequently the lower the average temperature of the flame. If, therefore, we desire to obtain the highest possible temperature from the combustion of a given gas, we must endeavour to so arrange the conditions that the combustion can take place in the shortest possible time.

Let us next consider what the hindrances are to a rapid combination of the combustible gases and oxygen. The first of these is that known as "dissociation"—namely, the fact that when the products of combustion (*e.g.*, water vapour and carbonic acid) are heated above a certain temperature, they commence to undergo a partial decomposition into hydrogen and oxygen, or into carbonic oxide and oxygen; the extent of this decomposition then increasing further with increasing temperature. Put in another way, when the temperature of a flame reaches a certain point, the combustible gases left uncombined are no longer able to unite with the oxygen present; and these only finally combine with the oxygen and evolve their heat of combination when the cooling of the flame by radiation has lowered the temperature sufficiently to enable them to do so. Thus, taking again our particular example of hydrogen burning in oxygen, the heat evolved by the combustion of a portion only of the hydrogen raises the temperature of the mixed gases to such a point that the unburnt hydrogen is no longer able to combine with oxygen, or, more correctly, at this temperature, as fast as hydrogen combines with oxygen, an equal quantity of steam is decomposed into hydrogen and oxygen, the heat of combination in the one case exactly balancing that absorbed by the decomposition in the other. In spite, therefore, of the uncombined hydrogen present, the temperature of the flame does not increase above this point; and the final combination of the gases only takes place as heat is lost from the flame by radiation.

This phenomenon of dissociation is, perhaps, the main reason why the flame temperature of hydrogen which can be obtained under the most favourable conditions is less than 3000°, instead of the calculated figure of 6790°, and renders it unlikely that it will ever be possible to obtain temperatures of much over 3000° by combustion. On the other hand, when temperatures below 2000° are required—which is the case in by far the greater number of practical applications of gas—dissociation has but little influence; the latest work on the subject tending to show that at temperatures lower than 2000° both steam and carbonic acid are only very slightly decomposed.

There is, however, a further factor of the utmost importance in determining the amount of heat which is lost by radiation from the flame—namely, the rapidity with which the combination of the combustible gas and oxygen takes place—for it is obvious that the shorter the time this takes, the smaller is the opportunity for loss by radiation to occur, and the greater the amount of heat retained in the flame, and therefore the higher the average temperature of the flame. Now, in addition to the dissociation, the rapidity of combination is affected by other conditions, and more especially by the extent to which the combining gases are mixed together before they reach the flame.

Let us consider, in the first place, what happens when a jet of hydrogen issuing from the open end of a tube burns in oxygen or in the air. In such a case, the hydrogen and oxygen molecules only meet on the outside of the flame; and the actual chemical combination only occurs in a thin film just where the different gases intermix. Under these circumstances, the flame is really a hollow sheath; the interior of the flame consisting of comparatively cool unburnt hydrogen, which merely gets somewhat heated by the surrounding hot sheath of flame. Here, therefore, though the thin sheath may be intensely hot, the average temperature of the flame throughout the whole flame is comparatively low.

If, on the other hand, we add to the hydrogen before burning the necessary amount of pure oxygen, and allow the gases to become thoroughly mixed, we get the very best conditions for the quick combination of the gases, as each of the hydrogen molecules finds the necessary oxygen close at hand; and with such a mixture a flame is produced which is exceedingly small, but has a very high temperature. Unfortunately, the rate of combination under these conditions is so rapid that, if any attempt is made to burn such a mixture from an open tube, the combination takes place not merely at the end of the tube, but the flame travels back along the tube as an explosion wave, the velocity of which increases rapidly, until it is equal to that at which sound travels in the gas, and the whole of the mixed gas combines with explosion. For practical application as a flame, the mixture of the gases must therefore only be made just before the point of ignition; and this is done in the familiar oxy-hydrogen blowpipe, where a jet of oxygen at high velocity mixes with the hydrogen just before the end of the tube at which the latter is burning, thus producing one of the hottest flames with which we are acquainted.

If, on the other hand, we use air in place of oxygen, we get a lower flame temperature for two reasons—first, because, as already mentioned, in addition to the steam formed, the nitrogen in the air (amounting to four times the oxygen volume) has now to be heated up by the combustion of the hydrogen and oxygen, and as there is more matter in the flame to be heated up by the heat of combustion of the same quantity of hydrogen and oxygen, the temperature attained must of necessity be lower. But, in addition, another less manifest effect then comes into play, which further reduces the temperature—namely, that the inert nitrogen molecules get in the way, so to speak, between the hydrogen and oxygen molecules, and so increase the time taken before the whole of the hydrogen and oxygen combine, thus increasing the opportunity for loss of heat from the flame by radiation, and resulting in the production of a longer flame of lower average temperature. And exactly the same thing takes place if the combustible gas is mixed with an inert gas such as nitrogen or carbon dioxide; the flame temperature being again reduced, partly by reason of the additional quantity of matter in the flame to be heated, and partly because of the "blocking effect" of this extra quantity of inert gas, which slackens the rate of combination of the hydrogen and oxygen.

Although for the sake of simplicity we have so far mainly confined our attention to the case of the simple gas hydrogen, what has been said for this gas holds good for all combustible gases, and for mixtures of such gases as are present in ordinary coal gas or producer gas. From these considerations, it appears that if, in the application of such gases for heating purposes, we desire to obtain a very high temperature concentrated in a particular spot, the necessary apparatus should be so designed that the gas and oxygen required for its combustion should mix together as rapidly as possible so as to enable the necessary chemical combination to take place in the shortest possible time, and that the amount of inert gases present, whether mixed with the combustible gas or the oxygen, should be reduced to a minimum. On the other hand, if it is desired to heat a large apparatus uniformly to a moderate temperature, the opposite conditions are required, and arrangements must be such that the gases combine comparatively slowly, and give rise to a long flame which raises the apparatus more or less equally through its whole extent.

As an example of the latter, we may take the heating of a gas-fired retort-setting, where it is desired to raise the whole of the retorts in it to a uniform carbonizing temperature of about 1000° C.; while for the former we may take the application of coal gas to the heating of an incandescent mantle, in which the object is to obtain by the combustion of the gas a high local temperature concentrated as far as possible on the mantle itself. In the next lecture, therefore, I propose to consider these two applications of gaseous heating from this point of view.

Questions and Answers.

The PRESIDENT said the subject dealt with was pregnant with points; and he hoped there would be a good discussion.

Mr. E. G. STEWART (Fulham) remarked that there were two points on which he would like information. The first was, assuming a flame fully aërated, what was the effect of the composition of the surrounding atmosphere upon its temperature—by which he meant an excess of carbonic acid or nitrogen? This condition, he thought, was often likely to be met with where the combustion took place inside a closed chamber, like a furnace. Also, in connection with combustion under these conditions, it would be interesting to know if the temperature of the flame was increased in consequence of the presumably decreased radiation from it owing to the surrounding walls and bodies being hot. He also asked whether the heat evolved by cooling the condensed water in the calorimeter to atmospheric temperature, should not also be deducted, as well as the latent heat of steam in calculating flame temperature.

Dr. COLMAN said he was dealing entirely with flames burning in free air. In a furnace, they had radiation of heat from the flame to the setting; but it was manifest that they could not raise their brickwork to a higher temperature than they could get in the flame to start with. They wanted to know the maximum temperature that could be got with a flame before going into the other part—as to the effect of the flame on the heating of the setting. With regard to deduction for latent heat in determining the net calorific power, when considering only the question of flame it was only necessary to deduct the latent heat of the steam, and it would not be correct to deduct also the heat evolved by the cooling of the condensed water, as that heat was present in the flame.

Mr. A. W. ONSLOW always found it interesting, he said, to hear Dr. Colman speak; but one or two remarks that he had made had appealed specially to him—particularly the reference to dissociation. Several times he (the speaker) had had a talk with Mr. A. F. Browne, of Vauxhall, on this very subject—as to when the point of dissociation began, and how it was to be detected. When one was dealing with very high temperatures, the point arose as to

determining when dissociation began, and its effect. He hoped one day Dr. Colman would give them a little enlightenment on this. Then the lecturer spoke about heating in a small compass. He (the speaker) had lately experimented largely on this matter; and he found that getting the burner close in contact was a thing that had to be watched most carefully. In combustion chambers, they should not lose a fraction of space. He had found a difference to the extent of nearly 15 per cent. in the alteration of a combustion chamber for gases to the extent of 1 inch. The sort of "hit-and-miss" arrangement that many of them had for heating gases was, he thought, quite wrong. They did not take sufficient advantage of the conductivity of the fire-clays at the sides; and they did not utilize the gas when they had at last got it in combustion in the spot where it was actually needed. He had seen a flame cross from one side to the other of a furnace, when it was supposed to heat a plate above, though it was doing nothing of the kind. It took two hours to eventually find its proper basis, when probably twenty minutes was quite sufficient.

Mr. J. G. Clark (London) put a question with regard to a flame of air burning in an atmosphere of coal gas. It had occurred to him that such a flame would be a very good one for incandescent lighting. He thought he would get a bunsen flame that would just fit the mantle. He rigged up a piece of apparatus to do it; but unfortunately it was so difficult to control that he did not get any further. He had expected to produce a flame of very high temperature; but he did not know whether he was right.

Dr. Colman replied that, theoretically, he did not see why Mr. Clark should not do so. At the same time, it would be so exceedingly difficult to get a flame of just the same shape as the mantle, that he did not think it would be practical. In some respects, Mr. Scott-Snell did something of this sort. In his lamp, the air was compressed, and drew in the gas by aspiration, reversing the usual procedure; and as far as flame temperature was concerned, the result was probably pretty much the same.

Mr. J. W. Helps (Croydon) remarked that he had known Dr. Colman for some time, and was always struck by his desire to acquire information. His wonderful faculty for obtaining this information was only equalled by the great pleasure it afforded him to impart it to anyone needing it. He felt sure everyone then present would go away feeling that he had acquired more information, and that what he had learned would enable him to understand thoroughly many matters that had been almost sealed books to him in the past. He felt confident the members appreciated the kindness of Dr. Colman in coming and giving them such an admirable lecture.

Mr. Eve asked whether it would be of any advantage in getting a higher flame temperature to heat the air or the gas, or to heat them collectively, before mixing with the flame.

Dr. Colman answered that undoubtedly if they could utilize the waste heat for heating the gas up, then they could get the advantage in the subsequent temperature of the flame. Whether this paid in the case of the incandescent burner, he was not prepared to say; but, of course, it was done, as he would have to point out in the next lecture, in the case of producer gas. Regeneration would not, however, be of much use in the case of flames which were already so hot that much dissociation took place. But in the case of gases containing a large quantity of inert gas, the preheating of the air and gas was of great advantage, as in the case of heating retort-settings.

Mr. C. J. Dickenson Gair (Vauxhall) remarked that they had been given many things to think of in the lecture, which mainly dealt with the first principles of combustion. This, he took it, was really the introduction to Dr. Colman's next lecture on the practical side. He wished to point out that the combustion of coal gas was only a series of exothermic reactions going on between the oxygen and the gaseous constituents. It was interesting to note the great increase of flame temperature caused by the combustion of hydrogen in pure oxygen. What would be the effect of pure oxygen on the luminous coal-gas flame? Mr. Clark had raised a very interesting point in his remarks; but he (Mr. Gair) did not think they would get the same efficiency by burning air in an atmosphere of coal gas as in the ordinary way, because in the burning of coal gas one of the secondary causes of high temperature was the formation of acetylene from the methane. Professor Lewes gave a very instructive series of figures on the luminous flame. With gas in a burner containing 4·38 per cent. of unsaturated hydrocarbons, the acetylene amounted to 0·035 per cent. Half-an-inch above the burner, there was 4 per cent. of unsaturated hydrocarbons and 0·34 per cent. of acetylene. An inch-and-a-half above the burner, there was 1·53 per cent. of unsaturated hydrocarbons and 0·56 per cent. of acetylene. At the tip of the dark region, there was 1·98 per cent. of unsaturated hydrocarbons and 1·41 per cent. of acetylene, which was the maximum. As the acetylene and other hydrocarbons passed on through the flame, complex changes took place, denser hydrocarbons were formed, and carbon precipitated. Therefore, if they turned the flame inside out—and this was what they were doing by burning air in coal gas—the acetylene passed off unburnt, and they would get a real loss due to this effect. They could actually prepare acetylene by burning air in coal gas. He was surprised on reading some other of Professor Lewes's figures at the very cold part of the bunsen flame half-an-inch above the top of the burner. He (Professor Lewes) only found at this point a temperature of 56° C. It seemed almost impossible that in any part there was such a low temperature as this; but evidently it was so in the lower part of the inner cone. There was, undoubtedly, a wide field of research open to anyone who could invent a piece of apparatus for the better mixture of coal gas and air entering a burner. It was evident that, by eliminating as far as possible the obstructive action of the four molecules of nitrogen so as to bring fresh oxygen molecules constantly into play, a greatly increased efficiency would be obtained.

Mr. A. F. Browne (Vauxhall) said that, as bearing on the question of the theoretical or ideal temperatures of combustion, about which Dr. Colman had been talking, he thought he remembered having read something about ignition, or flame, being the point at which the temperature of combustion became exactly equal to the loss due to cooling influences.* For instance, they might bring a combustible and supporter of combustion together, and apply a light, and flame ensued. But they might also bring about ignition by heating both bodies gradually until they reached a temperature when they flashed into flame. Was it or was it not a fact that these gases had started to combine, and had combined in a degree, before they reached the point where the heating and the loss of heat became equal to one another and flame occurred? If so, was not this a source of loss of heat which would reduce the flame temperature below the ideal or theoretical point? And was it likely to be a factor of importance, or of trivial amount?

Mr. Colman said that with regard to Mr. Dickenson Gair's point, he was not going to be drawn that night into discussing the luminous flame. It was vastly more complex than the other. Mr. Browne raised another point, which was probably true, though he did not think it of great importance. It was true, in most cases at any rate, that when they took a mixture of gases such as hydrogen and oxygen and heated them to a temperature below what was ordinarily known as their ignition-point, slow combination did take place; but the heat was evolved gradually, and most of it was dissipated and lost, so that the temperature of the mass did not rise rapidly. He did not, however, think that in ordinary practice, where they ignited their gases at a burner, this had any appreciable effect.

A Member inquired whether it was of any real advantage to admit steam to the producer for heating a setting of retorts. He quite agreed with the advantage of simply allowing the steam emanating from the ash-pan to go to the producer; but he would like to know whether admitting live steam was beneficial.

Dr. Colman said the answer to this question depended largely upon local conditions. Even the steam from the ash-pan was a very variable quantity in different places. Any way, it was rather apart from the subject of the present lecture.

The President here remarked that Mr. J. W. Helps, the President of the Institution of Gas Engineers, had to leave the meeting; but he could not let him go without saying how glad the members were to see him. It was not the first or the second time they had seen Mr. Helps there; and he hoped, interested as he was in the younger men of the industry, that Mr. Helps was gratified to see the progress the Association were making. The members wished him a happy time during his presidency of the Institution of Gas Engineers; and he could assure him that, as far as the juniors could do so, they would support him.

Mr. Helps said he was much obliged for the kind remarks that had been made. It was always a pleasure to come among the younger members of the industry. He felt he had still a good deal to learn; and he did learn something when he came among the juniors. It was gratifying to note the great progress of the Association to which the President had referred. It seemed to him that everyone attended the meetings with the idea of gaining knowledge that would help him in his business, and, what was even more important, would help the industry. He congratulated the Association, and believed the members were doing splendid work for themselves, for the undertakings they served, and for the industry at large. It was very good of them to welcome him as they had done.

Mr. A. E. Broadberry (Tottenham) said there was one point in the lecture which had caused him a certain amount of surprise. In dealing with the question of dissociation, Dr. Colman approached it in regard to oxygen and hydrogen. He (the speaker) was always under the impression that with heat alone it was not possible to dissociate water vapour; and he took it that dissociation was due more to the presence of carbon compounds than to the direct action of heat.

Dr. Rostin expressed his pleasure at hearing the lecture, but remarked that Dr. Colman had dealt so much with undebatable facts that there really was not much room for discussion. As to burning air in an atmosphere of gas, he himself had made a few experiments in this direction; and it would be interesting to him to hear more about it.

Mr. L. F. Tooth (Senior Vice-President) said he had made a considerable number of experiments with regard to furnaces for melting purposes for the use of coal gas; and in the early stages he found that the results with air pressure were not so good as those with high-pressure gas. He had known the use of furnaces to be discontinued for the simple reason that the adjustment of the air pressure with the gas at various temperatures attained could not be expected of those in whose hands the work was generally left. With high-pressure gas, the thing was much more simple. He would, however, be glad to know whether in actual practice gas pressure was preferable to air pressure. Personally, he found he obtained the best results with various

* A letter on this subject from Mr. Browne appears in our "Correspondence" columns to-day.

pressures according to the heats required, and preheated air at 600° C.

Mr. T. F. CANNING (Junior Vice-President) asked whether a proper mixture of oxygen and gas could be supplied by gas undertakings on a large scale, or whether there would be any stratification of the gases, owing to their different density, in the mains while travelling to the consumer. There was another point rather outside the lecture on which he would like information. In an electric arc, was there, owing to the high temperature, any vaporization of the carbon, or was it simply that the positive carbon wore away, and the small particles of the positive carbon were carried on to the negative?

Dr. COLMAN replied that, with regard to air pressure and gas pressure, this was a point that would rather come into the next lecture. What they wanted for high temperatures was a uniform mixture of the gas with the primary air; and whether they could get it better by having gas pressure or air pressure, probably depended to a large extent on the construction of the burner. He thought possibly, with a properly constructed burner, it would be feasible to get very good results for temperature with the air under pressure; but the practical experience of the last few years had tended on the whole to show that it was better to have the gas under pressure. As to adding oxygen to coal gas, this, he thought, would always be too risky to undertake on a large scale for gas that had to be distributed; but if the gas and the oxygen were once thoroughly mixed, there would be no trouble from stratification. As to volatilization of carbon, undoubtedly it did volatilize in the arc, to some extent, as well as burn. Even with ordinary carbon filament lamps, where the temperature was much lower than in arcs, there was a film of carbon deposited on the inner surface of the globe, which diminished the light.

Mr. W. H. VANNER (Walton-on-Thames) proposed, and Mr. J. HEWITT (Old Kent Road) seconded, a hearty vote of thanks to Dr. Colman for his lecture and experiments; and this was carried with acclamation.

Dr. COLMAN, in acknowledgment, said it had been a very great pleasure to him to come and deliver the lecture. He had thoroughly enjoyed it; and he trusted that his audience had been able to get some reflection of this enjoyment. Of course, the lecture had been mainly theoretical; but he hoped next session to be able to continue the subject with a further lecture which, while perhaps being also to some extent theoretical, would have a very practical bearing on their work.

It may be mentioned that the latest recruit to the ranks of membership of the Association is Mr. A. Turner, the Manager of the Amersham Gas-Works.

The Flooded Gas-Works at Gennevilliers.—In the "JOURNAL" for the 1st inst., we gave some views of the works of the Société d'Eclairage, Chauffage, et Force Motrice at Gennevilliers, which, with the accompanying particulars, enabled our readers to form an idea of the extent to which the works were affected by the recent floods in Paris. We are pleased to learn from M. Chamon (who is a member of the Board and of the Technical Committee of the Company, and not the Vice-President, as was stated), to whom we were indebted for the views and information published, that the works are once more in full operation; and we cordially join with him in expressing the hope that they may never again be stopped by such a disaster as that which lately visited them.

Progress of Italian Gas Companies.—Judging from the report of the meeting, held on the 3rd inst., of the *Società Italiana per il Gas*, and its allied Companies, increasing output and greater sales of gas are the order of the day in Italy as elsewhere. The Company named are chiefly concerned in gas-works in Turin, Bergamo, Tortona, and Girgenti. The amount of gas sold by the Company in these four towns in 1909 was respectively: 20,136,802 cubic metres; 1,694,051 c.m.; 451,055 c.m.; and 325,389 c.m. The average increase compared with the previous year is over 5 per cent.; but the small undertaking at Girgenti is of interest, as the increase there was no less than 40 per cent.—showing what can be done by active propaganda even in small towns. The *Società Italiana* is also interested in two other Companies, the *Società Industria del Gas* and the *Società Ferrarese*. The former have an increase of 4·9 per cent., the latter of 6·3 per cent.

Revivifying and Utilizing Gas-Purifying Materials.—A patent has been taken out by the Société d'Eclairage, Chauffage, et Force Motrice, of Paris, for a method of revivifying gas-purifying materials by means of ozone; and another by M. Simonini for the utilization of these materials. According to abstracts of the specifications in the "Journal of the Society of Chemical Industry," the Gas Company's process consists in treating ferric oxide, sawdust, and lime, which have been used in the purification of gas, with ozone in the presence of moisture in a closed vessel; the ozone being in the form either of ozonized air or ozonized oxygen. By the method of M. Simonini, the purifying materials, comprising ferric oxide, sawdust, and lime, are first extracted with carbon tetrachloride or other organic solvent in an autoclave, in order to dissolve out the sulphur, which is afterwards separated from the extract by distillation of the solvent. The insoluble residue is treated with steam in an autoclave for two or three hours, and finally the residue is submitted to destructive distillation, or to distillation with alkali, in order to obtain the nitrogen as ammonia. The residue, after treatment with steam, may alternatively be treated with sulphuric acid.

YORKSHIRE JUNIOR GAS ASSOCIATION.

At an Informal Meeting of the Association held in December, Mr. M'Nab, of the Low Moor Gas-Works of the Bradford Corporation, introduced the question of the revision of existing methods of testing meters; and so much interest was manifested in the subject and his suggestions thereon, that he was requested to embody them in a paper for inclusion in the printed "Transactions." His promise to do so was fulfilled in his contribution to the meeting held on Saturday at the Leeds Institute, under the chairmanship of the President, Mr. S. W. SHEPHERD.

Mr. P. M'NAB (Low Moor) then read a paper, of which the following is an abstract, entitled,

SUGGESTIONS ON "THE SALES OF GAS ACT, 1859."

I propose to call your attention to the necessity for the revision of the statutory methods in connection with the testing and stamping of meters. These are governed by the Sales of Gas Act of 1859; and the very mention of that date is sufficient to provoke the inquiry as to its adequacy for modern conditions. A few years ago, some of the most prominent men in the gas industry spent a great deal of time and labour on the question of the standardization of meter-unions, and there can be no doubt that such an arrangement would mean a saving to all gas concerns; but I beg to suggest that my present subject is of far more importance, considering that the meters are working year after year under altogether different conditions from those to which they are subjected while being passed as gas measures.

I will give you a few reasons why I think the present Act unsatisfactory. After fixing the standard, the Act states in the first portion of clause 13—

Firstly, the meters shall be tested for soundness or leakage only, and not for percentage of error, when fixed on a horizontal base, and with gas under a pressure equal to a column of water three inches high, with a light or lights consuming not more than one-twentieth part of its measuring capacity per hour marked thereon, nor less than one-half of a cubic foot per hour, for all meters of a measuring capacity not exceeding one hundred cubic feet per hour, and not more than one-fortieth part of its said measuring capacity per hour for all meters of any greater measuring capacity per hour than one hundred cubic feet; and all meters found to work under such test shall be deemed sound meters, and any meter found not to work under such test shall not be stamped.

It is here that my first objection is raised. I think that the pressure employed for this test is insufficient, because the day of low pressure has gone by, and many ordinary consumers' wet and dry meters have to work under pressures very much higher than this. In fact, many are fixed for ordinary domestic purposes where the pressure reaches 6 inches water-column. Where wet meters are used, there is a greater displacement of water, some of which is often blown out of the meter altogether, through the tube in which runs the vertical spindle to the index, and often at the filling-tube. In some meters, this is prevented by the spindle having to pass through a stuffing-box. This leaves the filling-tube the weakest place, as it depends on how long the leather washer will stand the necessary unscrewing and tightening up. These precautions take away the vent from the front of the meter; and after watering, water is driven into the back portion, until gas reaches that place also, and comes on to the top of the water—thus forming a back pressure. If an attempt is made to work these meters above their capacity, the back pressure is relieved. Then it is only a question of the pressure at the inlet lowering the water in the front, and the float cutting off the supply. This continues until a vent has been given, and has been known to happen when the capacity of the meter was not being exceeded. To some extent this may be remedied, if the old practice of supplying a meter for double the number of lights marked on it is avoided.

A new dry meter will stand a much more severe test, but after several years' working will often show the necessity of an increased pressure when being tested for soundness. Dry-meter diaphragms are made from the skin of a mountain sheep or goat. Modern gas seems more readily to absorb the oil, and thus tells sooner on any bad workmanship, or an inferior quality of oil. A certain amount of gas is thus enabled to pass through the meter without being registered, which would probably not be shown under the present test, but still be taking place while the meter was working at a higher pressure on the consumer's premises. For instance, a meter may be gratuitously passing one or two bye-pass lights for incandescent lighting or in connection with automatic lamp-lighting. This may appear a mere detail until calculations are made of the number of such meters, with the amount the bye-pass consumes per hour, and the number of hours it is burning per year.

The second portion of clause 13 reads as follows—

The meter to be tested for percentage of error shall be fixed on a horizontal base, and shall be tested at a pressure equal to a column of water five-tenths of an inch high, and passing the quantity of gas or atmospheric air per hour which shall be marked thereon as its measuring capacity per hour; and the water used in such testing, and the air of the room in which such testing shall be made, shall be as nearly as practicable of the same temperature as the gas or air passed through the meter.

As these rooms are kept at a temperature of 60° Fahr., the

water, air, &c., used must be about the same. A difference of 1 per cent. is made by 5° variation in temperature. Now, supposing the account of a consumer through some cause or other is larger than usual, the registration of the meter is at once disputed; and it is sent to the Government inspector to be tested. The inspector keeps the meter in his room for some time, until it is at the same temperature (60° Fahr.) as the room; while in the majority of cases the meter has been working in a temperature of from 45° to 50° Fahr. in the summer, and in winter it often gets near freezing-point. Is this a fair test? Then it is tested for registration at 5-10ths pressure. Where are there consumers' meters to-day working at 5-10ths pressure? It must be admitted that there is room for improvement in the registration of all meters when worked to their full extent, with the higher domestic pressures now used. The following tests, using air at about 60° Fahr., show that an improvement would be made by an increase of pressure in the registration test.

These meters were regulated to pass their full capacity (18 cubic feet per hour) at each of the following pressures:—

"A" 3-Light Wet.		"B" 3-Light Wet.		"C" 3-Light Dry.	
Pressure in Tenths.	Percentage of Error.	Pressure in Tenths.	Percentage of Error.	Pressure in Tenths.	Percentage of Error.
5	2·4 Fast	5	1·42 Fast	5	Correct
10	2·5 ,,	15	2·40 ,,	15	0·5 Fast
15	3·0 ,,	25	2·60 ,,	25	1·0 ,,
25	3·6 ,,	35	2·46 ,,	35	1·5 ,,
35	3·9 ,,	45	2·25 ,,	45	2·0 ,,
45	4·1 ,,	60	2·25 ,,	60	2·4 ,,

A pressure of 50-10ths blows water out of meter "A."

The following were set to pass their respective full capacities only at 5-10ths pressure, and the pressure was then gradually increased:—

Pressures.	5-10ths.	15-10ths.	25-10ths.	35-10ths.	45-10ths.	60-10ths.
Size of Meter.	Percentage of Error.	Percentage of Error.	Percentage of Error.	Percentage of Error.	Percentage of Error.	Percentage of Error.
5-lt. Wet No. 1.	1·25 fast	0·75 fast	0·40 fast	Correct	0·4 slow	1·0 slow
3-lt. ,, No. 2.	2·00 ,,	1·60 ,,	1·00 ,,	0·75 fast	..	..
3-lt. ,, No. 3.	2·40 ,,	1·83 ,,	1·01 ,,	0·60slow	..	..
3-lt. ,, No. 4.	1·52 ,,	1·25 slow	3·38 slow	4·76 ,,	..	..
3-lt. Dry No. 1.	Correct	1·48 ,,	Correct	2·04 fast	Irregular	..
3-lt. ,, No. 2.	0·50 fast	0·50 ,,	,,	2·40slow	2·50slow	3·0 slow
3-lt. ,, No. 3.	0·50 ,,	Correct	1·00slow	1·75 ,,	2·00 ,,	2·4 ,,

The meters tested were all new, and made by various manufacturers. The wet meters were of different construction; the 5-light being one of the most suitably constructed wet meters, to give good and steady lights, and also maintain supply when working under the higher pressures. You will observe that this particular meter, and Nos. 2 and 3 of the drys, are within the limits of error allowed, at all the pressures stated; but they go gradually "slow" with the increasing pressure. From these tests, it may be assumed that, with meters stamped when 3 per cent. slow at 5-10ths pressure, there will be a further loss to the gas concern in proportion to the increase in pressure, and the extent to which the original capacity of the meter is exceeded. The loss to the consumer would be reduced in proportion to the extent that the limit "fast" is exceeded. There are very few cases, however, where the consumer's meter is not called upon to deliver gas above its capacity at various times, owing to the rate of consumption, when ungoverned, or even the smaller class of stoves, fires, &c. The wet meters tell more readily when their capacity is being exceeded, as when the stated pressure had been reached with Nos. 2, 3, and 4, it was shown by the action of the floats that satisfactory lights could not be obtained with an increase in pressure, or that water would be blown out. There being no such inconvenience with dry meters, it has led to their more general adoption in connection with heating purposes; and it will be seen that more care should be taken that they are not overworked. When works' station meters are not kept at 60° Fahr., corrections are usually made when stating the amount of gas manufactured. But it is not practicable to do this with consumers' meters; and as the unaccounted-for gas is the difference in the registration of these two, this forms an important contribution.

Clause 12 provides—

Meters not to be stamped if more than 2 per cent. incorrect in favour of the seller or 3 per cent. in favour of the consumer, and to be stamped if erroneous to no greater extent.

This means that a meter would be stamped if 2 per cent. fast or 3 per cent. slow. I do not think that the range of error should be greatly reduced; but why should it not be the same on each side? If this difference of 1 per cent. in favour of the buyer has been allowed on the assumption that all meters go gradually "fast," it is like admitting that they are only meters within the meaning of the Act for a few years. Personally I cannot say, from the recorded testings of meters changed, or brought in through removal, whether the majority do so or not, because if our meters are found faulty in any of the previous tests, for soundness, lights, escapes, &c., as a rule, time is not wasted by this further test. Even if the time could be spared, I should not rely very much on it. Only in special cases—such as doubtful or disputed accounts—is this test made. Mr. James Stratford, Gas Meter Inspector for the City of London, in the course of his report for the year ending Dec. 31, 1908, says: "Of the meters tested for disputed registration, 3083 were found to be correct, while 3527 were wrong; 1304 being fast and 2223 slow." Evidence of this kind provokes thought, and should lead to action. It is evident that the meter "without float" is considered a special, and should be tested as such—viz., at the pressure and temperature of the place where it is intended to be used.

Clause 10 reads—

No meter duly stamped under the authority of this Act shall be liable to be re-stamped, although the same may be used in any other place than that at which the same was originally stamped, but shall be considered a legal meter throughout the United Kingdom, unless found to be incorrect within the meaning of this Act.

This appears to be the greatest objection to any alterations being made; but surely a more approximate average of the conditions could be obtained which would bring the testing more up-to-date.

Clause 19 reads—

The fees for examination, comparison, and testing, with or without stamping, meters shall be sixpence for each meter delivering a cubic foot of gas in four or more revolutions or complete repetitions of the action of the meter, and one shilling for each meter delivering a cubic foot of gas by any less number of revolutions or complete actions or one revolution or complete action; and for each meter delivering more than one cubic foot of gas by one revolution or complete action, the further sum of one shilling for every cubic foot of gas delivered at one revolution or complete action beyond the first cubic foot.

This makes the fee for stamping—

Wet Meters.		*Dry Meters.*	
2 light 6d. ..	150 light 7s.	2 light 6d. ..	150 light 5s.
3 ,, 6d. ..	200 ,, 10s.	3 ,, 6d. ..	200 ,, 6s.
5 ,, 6d. ..	250 ,, 12s.	5 ,, 6d. ..	250 ,, 7s.
10 ,, 1s. ..	300 ,, 15s.	10 ,, 1s. ..	300 ,, 8s.
20 ,, 1s. ..	400 ,, 20s.	20 ,, 1s. ..	400 ,, 14s.
30 ,, 1s. ..	500 ,, 25s.	30 ,, 1s. ..	500 ,, 20s.
50 ,, 2s. ..	600 ,, 30s.	50 ,, 1s. ..	600 ,, 22s.
60 ,, 3s. ..	800 ,, 40s.	60 ,, 1s. ..	800 ,, 25s.
80 ,, 4s. ..	1000 ,, 50s.	80 ,, 2s. ..	1000 ,, 33s.
100 ,, 5s.		100 ,, 2s.	

To have meters stamped *in situ* is even more expensive. All gas-meters should bear the Government stamp. Is this the case with water or electricity meters? If not, why should such large sums be charged for the larger sizes of gas-meters?

The success which in recent years has attended the supplying of high pressure gas direct from the mains to the point of consumption may be considered a reason for the insertion of a new clause, dealing with meters intended to register the consumption of this gas. Theoretically, gas at high pressure can be measured by both wet and dry meters, as the pressures should be the same on each side of the drum or diaphragms, as the case may be. For practical purposes, the dry will be found the most advantageous, as the wet will require a great deal more attention to give satisfaction to each party, owing to the amount of water being evaporated, due to the extra dryness of the gas, causing unsatisfactory lights, or the supply to fail altogether. Where a meter "without float" is used, the liability to pass gas unregistered will be much increased.

The dry meter is affected by the dryness of the gas abstracting oil from the diaphragms, thus allowing the gas to pass through the pores, and be consumed unregistered. The valves must also suffer in this case, as the gas has generally been relied upon to contain sufficient lubricants for them. But before this stage has been reached, a wet meter would probably have cost a deal more in attention, besides having to be watered more frequently than when working at ordinary pressures. As they are at present made, the cases of the meters are likely to prove a weak place in both instances.

Referring again to clause 13. These meters have been tested for registration at 5-10ths pressure water-column, and have passed as measures if not more than 2 per cent. fast or 3 per cent. slow; but while working at 54 inches of water, or 4 inches of mercury which appears to be the pressure most generally employed, the meter would be registering about 13 per cent. slower than when originally tested, and will not be a meter within the meaning of the Act.

The matter of payment for the gas, corrected for the loss of volume due to compression, may be arranged with the consumer by agreement. Still, it is not advisable to keep adding to the several existing agreements between consumers and gas undertakings, even if such a course be quite legal. A better method would be to use a specially made index, and charge in the usual way. As the demand for this gas increases, it will be met by improvements in the meters to be used for its registration; but testing such meters at 5-10ths water-column pressure is wide of the mark.

Unlike other weights and measures, it is optional whether a meter when once tested and fixed shall be re-verified; and many work twenty or more years without being tested again. This is an unsatisfactory state as between buyer and seller; and some reasonable period for re-verification should be determined. In addition to the report by Mr. Stratford, evidence has been supplied by the Manchester Corporation, who recently decided that all gas-meters which are owned by the consumer and have been used by them in the Manchester area of supply for a period of

ten years should be re-tested. Out of a total of 676 such meters tested, there were only 135 found correct, while 541 were incorrect, equal to 80·1 per cent. Where this is not done at present, there should at least be a periodical testing of meters for soundness. This can be carried out to a certain extent *in situ*, by having the full supply on at the inlet and burning the gas at the tap nearest to the outlet side of the meter until the pointer on the small testing-dial has reached a figure; or with wet meters a figure on the testing drum above the index should be brought opposite the stationary pointer, and the gas then be reduced to a small light by means of the tap on the outlet side. An observation of a few minutes will then show approximately the condition of the meter.

The necessity of an index test has already been urged; many errors in the registration of meters having been traced to this part. In the event of the present index being adapted to register the correct amount of gas consumed through high-pressure meters, it will be most essential that a test for this part of each meter should be incorporated in any future Act. Some material difference should be made in the seal affixed to all meters used for the sale of high-pressure gas, so that the two classes of meters may be easily distinguished.

The Act exercises no control over the automatic attachments to meters, though in prepayment consumption they are the predominant measures. Being part of the whole prepayment meter, this mechanism should be tested for accuracy before the meter is stamped. Take, for example, a few prepayment meters set to give (say) 25 cubic feet for 1d. At times some of these will give only 23 or 24 cubic feet; but for the next coin inserted 26 or 27 cubic feet are given, or *vice versâ*. So that with four coins put through, and then tested, the proper amount of 100 cubic feet is given. The average of another meter gives 1 cubic foot over for every coin. Thus, when 2500 cubic feet have been paid for by inserting 100 pence, the meter indicates that 2600 cubic feet have been used. This is generally called a "short" by the collector, and an "overplus" is given by attachments with an average below what they are set to give. Many complications have arisen through such prepayment meters; for though a consumer will be delighted to have money returned from the meter, it is not desirable to be knowingly inaccurate, and it cannot be legal to retain an "overplus" to make up for other "shorts"—especially so where signed agreements have been made so that in cases of dispute the consumer pays for what the meter has registered. It is another thing to obtain payment for "shorts" where there is no agreement, if the meter proves correct within the present meaning of the Act.

Perhaps the growing proportion of prepayment meters in use may hasten the revision of the whole question of meter testing, as, being an invention subsequent to 1859, they are only dealt with under the Act so far as the measurement is concerned, and not as regards the accuracy with which they give the purchased amount of gas. Through some cause or other, the whole question is bound to be re-opened sooner or later; and, in the meantime, the compilation of statistics of meters coming under our own observation, with full details of extreme cases, is a profitable piece of preparatory work for any who can join in it.

Discussion.

In response to the Chairman's invitation,

Mr. W. HOLE, Superintendent of the Gas Distribution Department of the Leeds Corporation, opened the discussion. He remarked that it was not easy to follow intelligently the experimental details given in the paper without having copies of them actually in one's hands, still less to criticize them profitably. One point of view adopted in the paper was very important and interesting—viz., the obvious difference between the conditions prevailing now and those under which meters worked fifty years ago, and its consequent bearing on the adequacy and satisfactoriness of the existing tests for meters. Thirty years ago, pressures of from 5-10ths to 10-10ths of an inch at the burner were considered to be meeting all requirements; now 15-10ths to 25-10ths were necessary. It was obvious, therefore, that a meter was not necessarily satisfactory because it passed the statutory tests. For example, in the case of a wet meter, there was, while it was working, a difference in the level of the water inside and outside the drum, caused by the back-pressure thrown by the drum. If this amounted to (say) 2-10ths, the water-level inside would be depressed 1-10th, and outside it would be raised to a similar extent. If the quantity that the drum was meant to pass was largely exceeded, friction, and consequently the back-pressure, increased. The level of the inside water was then still further depressed; the measuring capacity increased; and the meter therefore registered slow. In some of his tests, Mr. M'Nab had found meters becoming faster and faster with greater pressures. This would almost presuppose a lessening of friction, which could hardly be probable. He should like further light on this point. It was desirable never to work wet meters above their normal capacities, not only because, as he had just mentioned, this led to their registering slow, but because, if carried too far, it would result in some gas passing through the meter without being registered. To lessen the friction and allow of the ready passage of water from one chamber to another, the central edge of the partitions of the drum was cut away in a curve, and an extensive lowering of the internal water-level would allow gas to pass by this means from the receiving to the discharging chamber. This applied also to an overworked station meter. In this connection, the question of gas temperature was even more important. The volume recorded by the station meter was commonly corrected to 60° Fahr.; but in many cases this was still not done. He knew of works where the average gas temperature at the station meter would be about 50° Fahr., and no correction was introduced. As every 5° Fahr. represented a difference of 1 per cent. in the gas volume, such works would start with the unaccounted-for gas 2 per cent. lower than similar works where the gas volume was corrected to 60° Fahr. He congratulated Mr. M'Nab on his industry in obtaining details of valuable comparative tests, and on his lucidity in expressing his views on a very important and pressing subject.

The PRESIDENT asked if Mr. M'Nab had any suggestions to make as regards dealing with the difference between the temperatures at the station meter and at the consumers' meters.

Mr. J. H. HILL remarked that, after all, they had to work pretty much by averages, though he admitted that this might be bad with slot meters, where they needed to be as accurate as possible. Unaccounted-for gas often admitted of some degree of adjustment, especially on the score of temperature. He had had a good many observations taken of the temperature of the gas in his mains during the wet and cold summer of last year, and had been struck with the extent to which such readings were below the average for the time of year. He would take the opportunity of thanking Mr. Hole for calling their attention, in his book on the "Distribution of Gas," to the possibility of meters passing small amounts of gas without registering; for he had himself found the need of keeping a strict look-out on this point.

Mr. W. CRANFIELD pointed out, in extenuation of the absence of copies of the details of tests, that these were to have been put on a blackboard, so that all could follow them; and it was only when too late that the absence of such a convenience in the room was noticed. He would emphasize the need of the very finest quality of almond oil for use on dry-meter skins. He said it would never do to ignore the great distinction between what were known as English and foreign almond oil, or to incur the risk of using an adulterated article because it was a little cheaper. A consignment of such an oil might entail far-reaching consequences in rapidly deteriorating skins and gas-meters soon becoming leaky and slow, and this being unnoticed and unsuspected because happening early after being repaired. The American Gas Institute, in their recent report on "Calorimetry," recommended that all experimental gas-meters should be tested at the pressures under which they would be likely to work—thus admitting the validity of Mr. M'Nab's main contention.

Mr. M'NAB, in reply, pointed out to Mr. Hole, in regard to his tests, that he had stated in his paper whether the meters were regulated to pass their respective full capacities at only 5-10ths pressure or at all pressures. In the former case, increase of pressure uniformly produced increasing slowness of the meter, as Mr. Hole had stated would happen; and this would be the condition with ordinary meters. Only in meters re-adjusted for each change of pressure so as to deliver no more than their indicated capacity did increasing fastness show itself. As regards Mr. Shepherd's question, he thought that even if 60° Fahr. was an average air temperature, a lower figure might well be adopted as an average gas temperature.

[Specimens of sewn and unsewn skins, diaphragms, &c., were passed round for examination.]

Gas-Fires and Ventilation—A Correction

Some misconception has been caused, and not a little dissatisfaction, by an erroneous report that appeared last week in the "Yorkshire Post" regarding a lecture by Mr. E. W. Smith on "Fuel and Ventilation." The report was necessarily much condensed; and the keenest regret is felt in gas circles in the district in which the "Post" circulates that any unfair representation of the views of Mr. Smith—a representation derogatory of gas-fires—should have obtained such publicity, inasmuch as it is widely known that that gentleman is responsible for the gas-heating research work that is being carried on, in connection with the Institution of Gas Engineers, at the Leeds University. The words in the report (which, it is obvious, are not Mr. Smith's, but an inference of the reporter's) that are misleading are the concluding ones in the statement: "Gas-fires were a saving in expense, but he did not particularly advocate their use." A correcting letter from Mr. Smith has since been published. In the course of it, he writes: "One of my objects was to give an impartial account of the state of our knowledge with regard to the efficiency of gas-stoves. In comparing them with coal fires, I did not wish to express any preference or final judgment; but I should like to say that my sympathies are with the use of gaseous fuel, and that I look forward with confidence to its extended application in gas-fires of the best modern type."

Gas Companies Standard Burner Bills.—It will be seen from our "Parliamentary Intelligence" that these Bills have been referred to a Select Committee of the House of Lords, to be presided over by Lord Joicey, the Chairman and Managing-Director of Messrs. James Joicey and Co., Limited, and the Lambton Collieries—the two largest colliery companies in the county of Durham. The Committee will meet on the 7th prox.; and all parties concerned may, we think, congratulate themselves on the selection of the Chairman.

COMPETITION & DEVELOPMENT OF GAS SALES.

In last week's "JOURNAL" (p. 738), there appeared a paper by Mr. B. J. BELL, on "Competition and the Development of Gas Sales," which was read at the last meeting of the Midland Junior Gas Engineering Association. Unfortunately, the report of the discussion was crowded out of that issue; but it is given now.

Mr. R. J. ROGERS (Birmingham), after voicing the pleasure of the members at having submitted to them a paper which gave such ample scope for discussion, remarked that the question of developing their business was, of course, an all-important matter. Electricity undertakings, as shown on Diagram No. 1, were making very extensive progress; and he thought gas engineers generally were fully alive to the need for activity and vigilance to combat this competition. With reference to Diagram No. 2, he noticed the author said this showed the sales of electricity for lighting and power purposes in the case of certain undertakings. He (the speaker) took it that the figures did not include the power current employed for traction purposes. As to the methods of charging for electricity, it was stated in the paper that these were varied. There was no doubt that they were very varied; and electricity companies did not seem able to come to any satisfactory agreement among themselves as to what system they should adopt. The proposals of a "Fixed Price Company" were mentioned. Well, it would be rather interesting to note the results of this scheme in twelve months' time. He did not believe it was a system that was going to prove very satisfactory. It did not seem to him that gas had much to fear from the competition of electricity for heating purposes. Of course, at present it was more or less of a novelty; but it really appeared as though the heating of such things as curling irons was about the most useful purpose to which electricity could be put in this direction. Certainly, no opportunity should be lost whereby people might be educated further in the uses of gas. Doubtless the public generally were becoming more enlightened as to its advantages; and many of the old prejudices were dying out. The importance of paying attention to the builders and architects was a point that could not be too strongly emphasized. From his own personal connection in business with architects and builders, he found that at the present time they were not well advised as to gas matters generally. As the author of the paper remarked, they were usually rather inclined to electricity. The system he had himself adopted, however, in his particular portion of the business was to obtain the addresses of all the architects and the builders in the district, and systematically call upon them from time to time. Thus he was able to keep in touch with them, and, when premises were being erected, to advise them as to the size of pipes necessary and the provision that should be made for gas apparatus. Very often the builder, if left to himself, did not give due consideration to these matters; and the result was that when the tenant got in, he found that no provision had been made for gas apparatus which he would otherwise have used. To instal these appliances subsequently might necessitate structural alterations, the cost of which the tenant would not care to incur; and so the idea of using gas would be discarded. Money and trouble were well expended by gas undertakings in seeing that architects and builders were fully looked after. As to small pipes, there, again, arose the necessity of keeping in touch with the builder. If pipes were put in too small at first, there was everlasting trouble afterwards. In the majority of cases, it was not the builder, the owner, or the architect who was to blame for this, but the "jerry" gas-fitter, who got 1s. a point, or something like this, more by putting in the small pipes, and did not care what the consumer might suffer subsequently. They should do what they could to stop this. With regard to the inspection of gas-engines, he quite agreed that something should be done in this direction. He had sometimes come across engines working under very adverse conditions, due possibly to some slight defect. Gas engines might be given up in consequence of some little trouble which a proper inspection would have overcome. If such an inspection was carried out systematically, it should certainly lead to good. There was undoubtedly a great field for the development of high-pressure gas; and much attention was being given to the question. In Birmingham, they were hoping before long to hear more of this important phase of gas supply. In conclusion, he thought the maintenance of consumers' gas-fires should have more attention than was at present the case. Frequently he came across gas-fires working under villainous conditions, which certainly were of no advantage to the gas undertakings. In some places, he believed, it was the custom in the early part of the autumn to make calls on all consumers who were known to use gas-fires. This was done either at a nominal charge or gratuitously. This was a matter that everyone interested in increasing the consumption of gas should take in hand.

Mr. B. SKIDMORE (Smethwick) inquired whether the system of hire-purchase of gas-engines was adopted in any particular town; and, if so, with what results, both to the hirer and to the gas undertaking. With reference to the use of high-pressure gas for industrial and other purposes, a short time ago, in another place, he had the pleasure of listening to Mr. S. R. Barrett, who gave an instructive lecture on the subject.* On that occasion the exhibition of apparatus in use and the results of experiments made were greatly appreciated by the audience, and were of great use to himself and other people engaged outside Birmingham who had not had an opportunity of seeing anything of the sort. A lecture of a similar character would no doubt be of great benefit to many members of the Association.

Mr. W. GIBBS (Birmingham) thought that there was very great scope even now for the increase of the sale of gas. One point was the hot-water circulator, which gas authorities should push, as there was a good field for them. They enabled a householder to discard his coal-range altogether, certainly through the whole of the summer. Great attention should also be paid to shop lighting, especially outside lighting. The only thing the electricians seemed to have to say was that they could put their lights inside the windows; and this had proved fatal in some cases lately. They hoped in Birmingham to more than hold their own with the aid of high-pressure gas. As to architects and builders, they should be induced to put in rather larger pipes than they had been in the habit of doing. When approaching a consumer, if the supply was in readiness, it would often lead to an order for the fixing of gas-fires. The gas undertaking really wanted in houses a little scullery to themselves now, for the cooker, the wash-boiler, and the circulator; but with a little persuasion, they should succeed in getting more room still in the future. Maintenance needed to be taken up very strongly, when good results should accrue. It was a means of retaining a consumer after an installation had once been put in.

Mr. A. N. COMELY (Windsor Street), referring to the question of gas-engines, expressed the opinion that gas undertakings would be more than repaid if they followed on the lines laid down by Mr. Bell—namely, indicating the gas-engines in use for power purposes, or generally advising consumers on their plant. When a customer had a new engine installed, he should be encouraged to make a set of gauges so that the positions of the valves and cams could be checked after the engine had been at work some time, because wear and tear always took place. If the engine got out of order, the consumption per horse power was much more. Another thing that was worth the attention of gas suppliers was the pressure. Many unsatisfactory results with engines were largely due to this matter. Engines would work well and satisfactorily with 15-10ths pressure, and they might run at 13-10ths or even less if the load was not great compared with the total horse power; but if they were loaded to within (say) 10 or 20 per cent. of their rated capacity, and the pressure dropped below 15-10ths, trouble began straight away. No engine would work well unless the bunsen tube was at a good heat; and unless there was a proper supply intelligently arranged, there was bound to be trouble on this account. In his opinion, as long as they could explode the charge in the cylinders with gas, it was a great pity to fall back on electrical ignition, simply owing to difficulties of this kind. Any trouble taken on behalf of the users of gas-engines, would repay the gas undertaking tenfold.

Mr. F. J. WARD (Knowle) said that, at the beginning of the paper, the author remarked: "If gas is to retain its present position, consumers and their requirements should be considered in much the same way as any ordinary manufacturing business caters for its customers." Were they to take this as a confession that gas undertakings had not done so in the past? If so, he must certainly demur. In his own particular case, he not only made the gas, but supplied it right up to the burner. He believed that about 98 per cent. of the work done in the district was carried out by his Company; and this had been so ever since he had been connected with the undertaking—about thirteen years. Therefore they were able to give that satisfaction to the consumers which they required. He believed he knew almost every single burner in his town; and he was aware of their peculiarities, as well as of the peculiarities of the customers. He did not, of course, suggest that this could be carried out to the same extent in Birmingham. With regard to the consumption of electric current shown in Diagram No. 1, if this included the amount used for traction purposes, the tremendous rise would be accounted for. Personally, though he was a gas manager, he was not going to say that gas was everything. There was a certain field for electricity. This was a fact that had been recognized by other gas managers, for some even had it in their own works. His feeling was that it was a great mistake that electricity and gas should be produced by different authorities, or at different works. They should be controlled, as they were in some places, by at least the same committee or the same board, if not by the same engineer. In this event, it would be possible to go to customers and say: "You can have electricity at a cost of so much, or gas at a cost of so much. Please yourself which you adopt." Only last week he attended the meeting of a gas company in which he was interested; and he suggested to the directors that they should take into consideration the fact that electricity would have to come into their district before very long, and that therefore they should be prepared, when the time arrived when it would pay anyone to supply it, to do the thing themselves, and so stop that miserable cut-throat competition which was seen to-day. If this course were adopted, there was no doubt that both suppliers and consumers would benefit. In his own case, he believed his Directors had resolved to do this when the time came that it would pay to supply electricity. Whatever gas people might do, there were some persons who would have electricity if possible; and it must be recognized that it was hopeless to expect them to do otherwise. Notwithstanding this, however, he

* A full abstract of this lecture appeared in the "JOURNAL" for Nov. 30, 1909, p. 607.

had great faith in the future of gas, which he believed was even more promising than its past. Gas-fires had recently been improved beyond all measure. The single fuel fire of to-day, with air and gas adjusters, was a vastly different thing from the fires of even a few years ago; and they were able to offer the public something, and say it was the thing they required, without hurting their consciences. But it was necessary to take into account the place in which the fire was to be fixed. Most of the fires were made for radiating purposes pure and simple. This had been made a great point of; and no doubt there was a great deal in it. But it must be recognized that all situations and all rooms were not the same; and before they could properly decide what to supply the consumer with, they must know the peculiarities of the apartment in which the stove was to be placed. His own office, for example, was damp; and he had put in a stove that heated and dried the air. A radiating stove pure and simple would be a failure there. It was necessary to exercise discrimination. He often tried to dry the air where rooms were damp. In his district, they piped practically all the houses. He frequently took a contract on at a loss, simply that he might keep other people out, and so be able to put in pipes which he knew would be efficient. He always made it a point that pipes should be put in so that gas-fires could be used in any room without giving any trouble to the consumer. It might not be possible for some to do this; but in his case, the matter was in his own hands entirely. The author suggested that rotary meters should be used. There was no doubt they were accurate if there was a fairly large amount of gas passing through; but were they correct if the consumption was rather small? He believed it was possible to pass gas without it being measured. It was necessary that gas-engines should be carefully looked after. There was a considerable amount of gas used in engines that was not consumed at all. A good many charges went through an engine that were never exploded. The bunsen tube not being kept hot was, of course, a great thing. By looking after this matter a good deal more satisfaction could be given than if it were not attended to. He had a gas-engine driving an exhauster in his works; and he thought all gas-works machinery should as far as possible be driven in this manner. It was not a good advertisement for a person to go to a gas-works to talk of gas-engines, and to find a steam-engine doing the work there. There were good and bad fitters; and it was their duty to educate them as much as ever they could. They required better workmen; for if they could secure them, they would obtain better results. With reference to gas pressures, he might say that he never made any alteration, night or day, year in and year out. One must be judged by results; and his leakage was not more than 3½ per cent. His pressures were, of course, a little bit higher by day than at night; and he maintained that with a high pressure during the day, the fitters could do better work. A leak would be noticed with a high pressure which would not be with a low one. If work was being done with low pressure in the pipes, that was to say, leaks would not show which would manifest themselves at night when the pressure was increased. Further, in small works the pressure was likely not to be put on and taken off when it should be. He would not alter his pressure for a great deal. Had Mr. Bell been troubled with petrol gas? In country districts this commodity had to be considered. If the author had any figures available, he would be glad to have them. Petrol gas people were quoting some extraordinary figures in competition with him. He heard they could supply at a price, including everything, equal to coal gas at 2s. per 1000 cubic feet. With regard to inverted burners, he would use an adjuster that would give one, two, or three holes, as desired.

Mr. Harold Jones (Stourbridge) asked what was the price of gas in Birmingham for power and industrial purposes. In using furnaces of any size, the price of gas would be a serious consideration. It would be a very good thing if someone connected with high-pressure gas supply would some time give the Association the benefit of his experiences of the use of this system for furnace work.

Mr. W. H. Johns (Saltley) remarked that at one time the gas manager was content to remain on the works and let the district look after itself. It was only of recent years that the sale of gas in the district had been pushed to any extent. As to Mr. Ward's reference to rotary meters, he took it that Mr. Bell meant that the meters he alluded to in his paper should be used as secondary meters. He (the speaker) knew that rotary meters were not absolutely correct; but he did not think the inaccuracy would be such as to make much difference in the gas account, seeing that the gas would have to pass through an initial meter. If anything, it would be to the advantage of the gas undertaking, because he thought the arrangement in most cases was to charge a certain price for lighting and a lower rate for heating or power. As the gas was measured initially, the secondary meter became really a small consideration. He was surprised to hear that at Knowle the pressures were not varied at all. Having been connected with a gas undertaking in the South of England where the pressures were varied, he might say, every two hours during the day, it astonished him to learn that a gas-works could be run throughout the 24 hours without any alteration of the pressure. He was also surprised to hear that the unaccounted-for gas was as low as 3½ per cent. But to put the matter perhaps in a better position, he would like to know the initial pressure at the works. Possibly, after all, the pressure was not so high as some of the members were accustomed to. Referring to Diagram No. 1, he did not know whether this was the usual way in which electrical engineers tried to show their increase. It seemed to him to be simply a means of endeavouring to show a greater increase in output than had actually taken place. At least, it appeared to indicate this diagrammatically. The author thought that the supply of electricity to workmen's dwellings was likely to increase in future. He (the speaker) remembered reading some time back that some buildings put up by the London County Council had been provided from top to bottom with electric wires and fittings; but when they were finished, there was some difficulty in obtaining tenants. At last the Gas Company—he believed it was the South Metropolitan Company—were approached, and it was then arranged that the whole of the premises should be fitted with gas lighting and cooking appliances. The result was that every tenement in this particular building was now let. He thought this was sufficient to show that electricity, at any rate in London, had not got such a hold on the working man as some people believed. There was no mention in the paper of the type of cooker that should be adopted for hiring-out—whether it should be packed or unpacked. In a great many towns—no doubt with due regard to capital expenditure—unpacked cookers were fixed; but his experience of the unpacked cooker was a very unsatisfactory one. Probably the consumption of gas was much greater; but he did not think that this was a proper way of cultivating business, because it led to dissatisfaction, owing to the time that the food took to cook. And even when it was cooked, he did not think it was done nearly so well as in a packed cooker. He was also much surprised to find in the paper no mention of the advantages of a central show-room. They heard sometimes of places where accounts could be paid; but when they came to look, they found it difficult to discover them. There should be a prominent place in all towns, which had not got to be looked for, but which would make itself known very quickly. Some gas undertakings did not possess such a show-room; but they should be provided, and fitted with everything of an up-to-date character. Whether they thought they could sell an appliance or not, it should be there for people to see; and lectures and cookery displays should be occasionally arranged. He knew of at least one place where for the last three or four years gas had been compressed and supplied at a high pressure direct to a number of outside lamps at a fixed charge, which included hire of lamp, maintenance, and gas. It was not originally intended to supply gas in this fashion. The installation was at first meant to light the show-room; but owing to the satisfactory results, various consumers asked if they could not also be supplied. The consequence had been that gradually the main had been increased for the service of further outside lamps, which were fed from it without governors. He would like to know what would be the pressure in the Birmingham high-pressure installation. The pressure he was thinking of was about 12 inches. Also, would the gas be measured by wet or dry meters? He should think dry meters; but the general practice in Birmingham up to the present had been to supply wet meters. Further, would any charge be made above the ordinary rate for compressing, &c.?

Mr. B. W. Smith (Walsall) said it had afforded him great pleasure to attend the meeting and hear Mr. Bell read his paper. He did not agree with Mr. Ward in the matter of having one general pressure. If he had had experience in a town of varying levels, he would find the pressures would have to be varied according to requirements. Of course, too, in a manufacturing place the conditions were entirely dissimilar to those of a residential one. If Mr. Ward would think these points over, he would not be too emphatic as to the desirability of adhering to one particular pressure. With regard to electricity, he (Mr. Smith) had an undertaking which, as was the case in Birmingham, was under the control of the Corporation; and there was always keen rivalry. There was no doubt that electricity was being pushed in every shape and form. What annoyed him most, however, was that the electricians were not satisfied with taking a consumer from the gas undertaking, but often that customer did not pay them to supply. The gas concern was paying a good sum over to the rates—which was a debatable point—and the electrical people took these consumers away to make a loss. This kind of competition was most unfair, and especially if electricity was being supplied for motive power and other purposes at a figure much below that at which it could be produced.

Mr. H. E. Copp (West Bromwich) expressed his appreciation of Mr. Bell's paper, which he thought was an admirable one in every respect. A great amount of information had been compressed into a very small space. He could have said a lot about the paper; but as the discussion had been long, he would let the members off with a few remarks. At the beginning of the paper, the author gave some figures as to the growth of electricity. This was surprising; but there was also shown the growth of gas, which he (Mr. Copp) considered still more surprising, when everything was taken into consideration. Electricity was a new thing; and a great many people were infatuated with it. He used the word advisedly, because it amounted to nothing less than infatuation with some persons. Of course, he admitted that electricity had its uses. It would be absurd to decry it on every point. In fact, he often recommended consumers to make use of electricity—he did himself—for compressing gas. Competition with electricity he thought was very healthy. He was not at all afraid of competition—he welcomed it. The more they had of it, the better gas would do in future, provided that the competition was fair, or as fair as they could expect to have it, at any rate. One point he wished to emphasize was that gas people should take the

greatest care to be strictly accurate in everything they might put forward, so that nothing might recoil upon the undertaking they served. Inaccurate statements were the sort of thing that did more harm than any amount of competition.

Mr. J. HEWETT (Birmingham) said, with regard to the progress of electricity, that Mr. Copp had drawn their attention to the fact that there was also an increase on the gas side; but he did not think he had made the position quite so strong as it actually was. Looking at the matter in one way, it might be said that the increase in electricity over the period referred to in the paper was shown to be something like 3000 per cent., while that of gas was only about 50 per cent.; but there was another way of looking at the matter. There was an increase in both cases; and of the total increase, the electrical people had only secured 25 per cent., while gas had obtained 75 per cent. This proved that gas was still in the running, and maintaining its lead. Reference had been made by Mr. Ward to rotary meters. He agreed with what was said by this gentleman. Some time ago, he (the speaker), when in the Black Country, saw a rotary meter being taken out to be replaced by a very much smaller one. He asked the reason, and was told it had been in use some time, but it had not measured any gas. If they were going to use rotary meters, perhaps the consumer would object if he had no deduction through the secondary meter not registering. The meter in the Black Country to which he referred was a large one.

Mr. JOHNS said he agreed with what had been said as applied to large meters, but not as regarded discount meters. He had some of the latter fitted up. They were not absolutely correct; but he thought they were near enough for all practical purposes when there was a differential price charged. He could not depart from his opinion that such meters were excellent things for arriving at the deduction to be made off the lighting rate for a power or heating supply.

Mr. WARD, in answer to a question Mr. Johns had put, said his pressure was 25-10ths always. As to Mr. Smith's remarks on the subject of a constant pressure, he (the speaker) could only say that he was foreman in a manufacturing district for many years; and he came to the conclusion then that if ever he was in a position to alter matters, he would do so. When he found people running to the works time after time, saying that they could not get engines to work because of the want of pressure, he thought it was only right that a change should be made. With regard to the rotary meters, he fully appreciated that they were to be secondary.

Mr. COPP, alluding to an inquiry by the last speaker about petrol gas, said that if Mr. Ward would take the calorific value of a gallon of petrol, and dilute it with as much air as he liked, he would find there was only a certain number of heat units. It was very easy to ascertain the flame temperature; and if he would do that, and spread it over as many cubic feet of air as he thought advisable, he would find that the price of petrol air gas was by no means comparable with that of coal gas at ordinary prices. It was, if he remembered rightly, equivalent to town gas at between 3s. and 4s. per 1000 cubic feet. At West Bromwich, they considered themselves to be among the pioneers in maintenance, and also in the inspection of consumers' gas-engines. They had not done much of the latter lately; but some time ago they were quite busy indicating consumers' engines, &c. This work was thoroughly appreciated by the consumers.

The PRESIDENT (Mr. A. O. Jones, of West Bromwich) remarked that the paper before them was one they could all discuss. Those on the works should do their best to get prices down, and those on the district should use every effort to increase the consumption of gas.

Mr. BELL said the discussion had been a long one; and it was not his intention to make a lengthy reply—more especially as many of the points raised had been already answered. The second diagram did not include anything for traction purposes. In the case of Birmingham, for instance, the increase would be five times, instead of three times, if traction was included. They were in the position at the present time that, however much they might admit there was a field for electricity, with the large amount of capital that was invested in gas undertakings, they must make this field as small as possible. Wherever they could, they must increase the consumption of gas, and eliminate the possibility of consumers becoming dissatisfied and ceasing to use gas. His paper was meant to draw their attention to the main points, so that they might be more thoroughly alive to the position of gas and electrical undertakings at the present time. The rotary meter was only proposed as a means of measuring gas for discount purposes. The cost was small; but the chief features were that very little space was taken up by them, and they could be fixed in any convenient position. They were, too, sufficiently accurate for the purpose for which they were required. As to fitters, the remark he made was intended more to apply to advertising. They could not help noticing that the contractors for electrical work were more pushing than contractors for gas work. Wherever there was an opportunity, they were actively canvassing, primarily to get work, but eventually for the electrical undertaking. In the case of one large concern, at any rate, it was not found necessary to employ canvassers, for the simple reason that every contractor was a canvasser. They could not say the same in connection with gas undertakings. It was a point whether it would not be better to have canvassers, as was done in some instances, to push the sale of gas. When he said canvassers, he meant men to call on every consumer in order to see how things were going on. The advantages of show-rooms were admitted; but they were so uniformly adopted, that he did not think the point worth mentioning. It was generally agreed that packed cookers were best; and unpacked ones were only used as a matter of expediency. He noted that high-pressure gas had been supplied to consumers without governing; and no doubt in future this field would be increased. The pressure in Birmingham, he understood, was to be 60 inches. The price would have to be decided later. The charge for gas for power in Birmingham was 1s. 6d. per 1000 cubic feet; and there was 3d. off the lighting rate for industrial purposes. He would like to congratulate Mr. Copp and their President, because he had noticed a remark from an electrical source that, with the cheap gas supply at West Bromwich, lighting was a secondary consideration. Cheap gas and inverted burners had upset the calculations of the electricians there. He was asked if he could give particulars of any place where gas-engines had been installed on hire-purchase. He had before him a letter from a gentleman connected with a large undertaking who had supplied the following engines on these terms: Two 190 H.P., two 140 H.P., one 110 H.P., and one 15 H.P. Of course, the consumption of gas would be considerable in the course of a year.

FORMATION OF COAL.

By Mr. H. E. DORAN, Assistant Chemist at Granton.

[Abstract of Paper read before the Scottish Junior Gas Association, Eastern District, March 12.]

The author began by saying he proposed to give a very brief sketch of the formation of the rocks constituting the coal strata, and a general idea of coal itself. The group of rocks with which they, as gas makers, had to deal comprised sandstone, shale or bind, limestone, coal, and underclay. That coal was mineralized vegetation was a point on which there was practically no doubt. It was composed of carbon, oxygen, hydrogen, with a small proportion of nitrogen, and therefore consisted of the elements which make up all vegetable organic compounds.

Taking a block of coal, the author pointed out that it consists of bright, clean coal, parted by thin layers of mineral charcoal. When a slice of this coal is cut parallel to the bedding, and ground down thin enough to transmit light, and examined under the microscope, it is found to consist of two parts. There is a black or dark brown granular ground mass, and scattered through this there are numerous semi-transparent discs and rings of a yellow colour. In a section perpendicular to the bedding, elongated yellow bars run through the ground-mass, roughly parallel to the bedding, and some of these are like vertically flattened hoops. It is clear that these yellow patches are the round spore-bags, which have been flattened by pressure. These bags average 1-20th inch in diameter, and inside them, and sometimes scattered through the ground-mass, very much smaller yellow spots have, in some cases, been noticed. Professor Huxley believed the dark ground-mass to be highly carbonized spores.

As coal is always found beneath a layer of shale and sandstone, and as these rocks were formed at the bottom of the sea, it follows that the land surface must have been submerged several times. On many parts of the coast, what are called submarine forests may be seen. These consist, for the most part, of stools of oak, beech, and fir trees; the roots being still embedded in the clay in which they grew. If one of these forest beds could be gradually depressed and covered up by new deposits, it would present the same character as an underclay of the coal. Wherever a coalfield is now found, a dense forest has at some period existed, consisting for the most part of gigantic club-mosses and tree-ferns; and as the seasons rolled on, these plants developed their spores and seeds and shed them in enormous quantities. These spores were of a resinous nature. This fact accounts for their preservation, while the greater part of the stems and leaves were rotted away by the long-continued action of the air and rain, or became converted into mineral charcoal; on the other hand, the spores and sporangia, preserved by their resinous nature, became converted into a compact and intermediary substance.

Coal far surpasses every other substance in value and importance as a fuel; yet it has come comparatively slowly into use—it being towards the end of the Thirteenth Century before it was much employed in London. In some parts of England, however, it had been burned long before this, as it is known to have been, to an extent, an article of household consumption by the Anglo-Saxons in the Ninth Century. There is also evidence to show that the Romans were acquainted with its use, as coal cinders have been found in the ruins of Roman buildings. For a long time after coal was introduced, strong prejudice existed against it. Proclamations were issued by Parliament forbidding its use in the reign of Elizabeth and Edward the First; and as late as the middle of the Seventeenth Century petitions were presented to Parliament against its employment in London, on account of its smell. Change and invention, however, soon made its use compulsory, as, for instance, the introduction of steam navigation in 1801, gas lighting in 1810, and, finally, the large extensions of the railway systems. The iron industry has also been a great factor in its use. A patent for employing coal for iron smelting was taken out in 1612; but it was a failure. It was tried again in 1618; but this attempt also failed. A third attempt was made

in 1713, but still without success; and it was not until coke was introduced in 1750 that this outlet for coal was assured and finally made certain by the introduction of the hot-air blast in 1830.

The PRESIDENT (Mr. H. Rule, of Falkirk) said the paper was one which, perhaps, could not be very much discussed; but if any members cared to offer any remarks, the meeting would be very glad to hear them.

Mr. D. BISSET (Edinburgh) observed that the subject was one which had been seldom dealt with in the Junior Associations, but thought it was just as well that they should have some theories and opinions as to how coal had been formed. They in the gas industry—and he supposed people generally—just accepted coal as coal; but Mr. Doran had taken them back thousands of years, and had shown them how coal was likely to have originated.

Mr. W. GEDDES (Edinburgh) said perhaps at some future time it might be a good thing if some other member were to take up the subject of the special kind of coal used by gas makers, and go into the matter thoroughly.

Mr. W. DUNLOP (Kirkcaldy) observed that with most of them their interest in coal ceased when they found out the yield of gas per ton, the quality of the coke, and the number and degree of impurities in it. Mr. Doran had taken them away on a different tack; and he thought they would be benefited by his paper.

The PRESIDENT said he was sure he voiced the opinions of all when he said they were very much indebted to Mr. Doran for his geological and historical paper. They were accustomed to seeing coal coming into the works, and they seldom paused for a moment to consider how it had been formed, or to reflect upon the countless ages it had taken to produce the material upon which their industry so much depended. Many theories had been advanced by geologists as to how coal came to be formed. Possibly they might never know the real truth of the matter. The best they could do—and this was what Mr. Doran had done—was to present to their minds a picture of what Nature was doing at present, in the way of depositing vegetable matter, and to think of the huge overturning and subjection to enormous pressure for centuries which coal had undergone.

THE RATIONAL ANALYSIS OF CLAYS.

A considerable part of the March meeting of the London Section of the Society of Chemical Industry was devoted to the consideration of a paper by Mr. W. C. Hancock on "The Rational Analysis of Clays." The subject is one in which interest has been intensified in the gas industry by Mr. F. J. Bywater's paper, on "Refractory Materials," read before the Gas Institution in 1908. In the opening of the paper, the author referred to the ultimate analysis of clays; and then at once admitted that the rational analysis does not give much information of use in the actual technology of the manufacture of clays. The rational analysis aims at the mineralogical separation of clays into three stages—clay substances, quartz, and felspar. But the accuracy of the results of the rational analysis appears to depend upon the method employed throughout the process. Consideration has to be given to the effect of the reagents upon the minerals present in the clays, the ratio of the amounts of these reagents, the strength of the reagents, and the methods by which the mass is dealt with. The author went largely into the history of the subject, and showed the various methods proposed for carrying out the rational analysis. He also exhibited a number of tables. In these there was nothing to complain about between the quantities calculated and the quantities found, except in the case of the felspar, which appears very susceptible to attack on the part of the reagents. In all cases there was considerable divergency in regard to the felspar between the calculated and the amounts found by the rational analysis—this being explained to be due to a large amount being carried over with the soluble clay substances.

In the discussion, Mr. J. W. Cobb, of the Farnley Iron-Works, near Leeds, said that he had found the rational method somewhat unsatisfactory. The ordinary treatment with alkali was too drastic. Dr. J. W. Mellor, of the "Ceramic Journal," regarded the subject as a very difficult one; and he should have liked Mr. Hancock to have expressed himself more particularly on what he considered was the bearing of the process. In published work on this subject, there were glaring inconsistencies, which were not cleared away by what had been seen and heard that evening. In his view, the rational analysis was a mere juggling with figures. Mr. Bertram Blount thought it should be the business of the chemists to discover a more perfect method of rational analysis. They wanted a method, which might be partly physical and partly chemical, by which they could quickly make an approximate analysis of the mineral bodies present in the clay. He thought perhaps that a synthetic method of attack could be adopted; and then, in his opinion, a great deal more would be ascertained than now. Dr. Howe remarked that Mr. Hancock had undertaken this work at his instigation; and the result was that he (the speaker) had come to the conclusion that the rational analysis as it stood at present was of no practical use. If some sure and quick method could be found, it would be very valuable. In replying to the discussion, Mr. Hancock observed that there was no doubt the rational analysis did afford a method of sorting out clays very rapidly indeed; and, for this purpose, it might be useful. But otherwise he confessed he could not say much for it.

MEASUREMENT OF LIGHT AND ILLUMINATION.

For the Meeting of the Illuminating Engineering Society last Tuesday, the subject chosen for discussion was "Recent Developments in the Measurement of Light and Illumination." The PRESIDENT (Professor Silvanus Thompson) was in the chair.

The PRESIDENT, in opening the proceedings, said the discussion that night would be devoted to the methods, rather than to the results, of photometry. The latter would be dealt with at the meeting a month hence. He had been asked by the Council to open the discussion with some brief remarks, and the exhibition of some simple and rough pieces of apparatus which he had used from time to time to illustrate to those who did not generally work with photometers, and who were not familiar with the process of photometry, the elementary matters on which photometry rested. The President then called attention to the large rough photometer that he used at the York meeting of the British Association to explain, approximately and quantitatively, the illumination of different sources of light; and, by its aid, he demonstrated many things well known to those versed in the art of photometry. A difficulty in the art was that of deciding equality when two illuminants were not quite of the same tint. It was a matter of judgment and experience in many cases. Assuming one had, by practice, attained good judgment on this point, then all the rest was science and not art. He next dealt with the various standards of light proposed, and in actual use, in different countries. Photometer heads and discs next came in for comment. The President is much in favour of the use of two blocks of paraffin wax, with a sheet of tinfoil between. It makes one of the simplest, and one of the best photometers. Another favourite disc of his consists of a thin piece of paper folded, with a piece of cardboard between, in which is a circular hole. "I do not like the grease spot," said the President. He referred to the Lummer-Brodhun photometer as a most beautiful and sensitive optical attempt to give a perfect bunsen grease spot. In conclusion, he dealt with the principle of flicker photometers.

Professor A. G. VERNON HARCOURT (one of the Metropolitan Gas Referees) remarked that he was afraid the subject of photometry, as the President had put it before them, was rather too large to be dealt with in its different aspects by anyone in a discussion of this kind; and he would only attempt to refer to one or two points. As to the question of the comparison of lights of different colours, this had been, as the President had told them, tried in various ways. There was the plan of Sir William Abney, which really gave rather good results. In it the movement made was a very rapid one, and corresponded therefore to some extent with the flicker arrangement. By presenting at short intervals a bluer light and then a redder light, it was possible to form a judgment as to the relative illumination of the two much better than could be formed by the actual adjustment of the distance. This certainly was so; and if there was no alternative, it was better to cause the two to quickly succeed one another before the eye, and so obtain the needed abstraction of the difference of illumination as a thing distinct from the differences of colour. He (Professor Harcourt) had tried various methods; and the one he had found to be the best was this: It was a disc that was in use some 40 years ago. It was called the Leeson disc, and consisted of an arrangement such as the President had shown as being better than the grease spot—that was to say, two surfaces of the same translucent paper, with another piece of opaque paper between, in which a hole was cut. In this way, one could obtain and compare one with another the illuminations at the opening which was covered by the folds of the translucent paper through which the light shone, and by which light from the opposite side was reflected. Having referred to the star disc, Professor Harcourt alluded to the experiments made some years ago at the South Foreland (in which, at the request of the Board of Trade, he took part), for estimating the amount of light which was given by lighthouses with different illuminants. There were three experimental lighthouses, one of which was fitted with an oil-lamp, the invention of Sir James Douglass, and which had been introduced into the Trinity House service. In another, there was gas, used in gas-burners arranged concentrically—one ring inside another. In the third house was a very large electric arc with carbons something like 1½ inches diameter. For the measurement of these lights, there were set up huts at different distances from the lighthouses, which were placed in a straight line at a distance of something like 30 to 40 yards apart. Perpendicularly with the line of the lighthouses, the huts were built—½ mile, 1 mile, and 2 miles away. The further distances were not so useful as the ½ mile one. In measuring the lights, there was used a small lamp that he had contrived, giving a flame light of 1 candle. It was a pentane arrangement. At this distance the 1-candle light had to be (say) 12 to 15 feet away; while the beam from the lighthouse (each one of them in turn) was projected through a lense at the open window; and this was received on the surface of the photometer. These lights were different in colour, especially the arc light. The practice was to use the star disc which was placed in the photometer; and on its one side was received the light (say) from the arc light, and on the other side that from the pentane light. Not in the actual experiments he was describing, but in others, a long tunnel was built (also for the purposes of photometry) at the South Foreland. A bar photometer was used with a star disc in the middle—the

electric arc being at a distance at the one end and the flame standard at a short distance at the other end. He had an opportunity of trying how far judgment by the plan he had described could be made by a number of men in the service of the Trinity House who had no experience of photometry, but were capable men. He gave them instructions as to what they were to do. He said to them: "Look at that star. You will notice that by moving it backwards and forwards, you will see a pink star on a blue ground, and a blue star on a pink ground. Now do not mind whether the one is blue or the other is pink, but think of the degree of clearness with which the pattern stands out on the background." He found it was not difficult to get these men to think of that. That was the point—the degree of distinctness of the pattern; and in that was his experience on the subject of colour photometry.

The PRESIDENT said the members were extremely indebted to their honorary member for giving this account from his experiments and experience at the South Foreland. He hoped that on some future occasion they might have a great deal more from the same source.

Professor J. A. FLEMING spoke on the subject of primary and secondary standards. He said that, in spite of the enormous amount of work that had been done in the attempt to realize a physical standard, he did not think they could consider they were yet in a thoroughly satisfactory position. There were three standards in actual use: In Great Britain and America, the pentane lamp; in Germany, the Hefner unit; and in France, the bougie decimale. These were all flame standards; and the light varied in a most marked degree, with the percentage of water vapour, the atmospheric pressure, the amount of carbonic acid, the composition of the fuel, the disturbance of the air by draughts, and other minute circumstances. These made differences in the lights which were not small matters; but the differences were not discovered until they began to apply the standards to electric light photometry. What was an astonishing thing to him in a great institution like the National Physical Laboratory was that, when they began to work on flame standards, they soon adopted secondary electrical standards; determinations were made for humidity and other things, and then they threw away the electric light standard. He did not think sufficient work had been done on an incandescent standard of light; and more pains should certainly be taken to obtain the advantage of the platinum incandescent standard. It was admitted that this was a difficult subject. But the purposes for which great national institutions were established were not to do the easy experiments, but the difficult ones. Difficulties had been largely minimized by recent experiments. And he did think the time was rapidly approaching when the question ought to be considered from the very bottom as to an international standard of light based on the incandescence of some material; and, in his view, no material was more suitable than platinum taken at freezing-point. At present there was nothing superior to the large bulb incandescent lamp for an incandescent standard. At University College, they began to make tests in 1895 with such lamps. They had some with which thousands of tests had since been made; and there was one of these lamps concerning which they had no evidence that it had varied ½ per cent. in fifteen years. This lamp had been compared with standards at the National Physical Laboratory, at the Pender Laboratory, and at the Reichsanstalt; and the figures were in remarkable agreement. If a secondary standard could be found to be so constant, he ventured to think much more labour might be put into the question of obtaining a primary incandescent standard that might be universally accepted, and which would be absolutely independent of moisture, of atmospheric pressure, of carbonic acid, and so forth. This was a work that really needed research at their great national laboratories.

Mr. A. P. TROTTER, referring to a list of questions that had been circulated in view of the meeting, addressed himself to the first one: "Are the courses of instruction and experimental facilities at technical colleges and scientific institutions for the study of photometry adequate, and what changes are desirable in the existing methods to suit modern requirements?" He said that when he began to write a series of articles on the subject of photometry some two-and-a-half years ago (which would probably go on for another year) he had not done any photometry for eighteen years. He did not want these articles to be from the arm-chair point of view only; and so he went round to see what was going on, and visited photometrical establishments of three kinds. He inspected the photometrical testing-rooms of various engineering works, the testing-rooms of lamp manufacturers, and those of the laboratories of technical colleges. Without even hinting at names, he must confess that he was amused at the antiquated and very limited apparatus that he found in the teaching laboratories. The teaching of photometry fell into two classes—the science and the art. Photometry seemed to him to be likely to fall between two stools—the two stools of physics and engineering. Physics alone as regarded the laboratory was most lamentably treated. In the laboratories he had seen, there had been apparatus twenty, thirty, or forty years old. That was all right in its time of long ago for testing gas; but from that they went to the other extreme, and had a highly accurate photometer, with nothing between. The subject from the educational point of view must be divided into two sections: The scientific part, which was extremely interesting; and the practical part—the art of getting good accuracies and avoiding errors—which was fascinating.

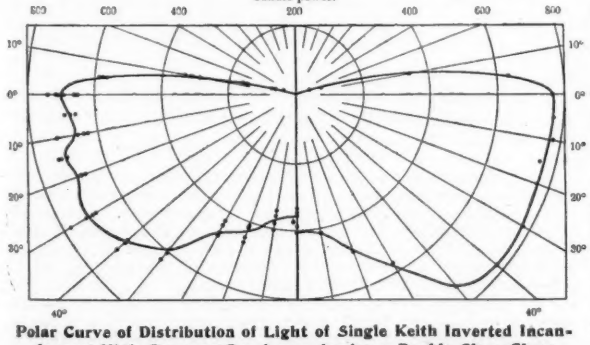
Mr. C. C. PATERSON (National Physical Laboratory), referring to Professor Fleming's remarks, said if he told those present all that had been done at the National Physical Laboratory, they would not get home that night. Professor Fleming had run-down the pentane lamp rather severely; but, in his opinion, the pentane lamp served them exceedingly well for the present as a temporary standard. One was able, with care in using the lamp, to reproduce the value of the candle from the pentane lamp with an accuracy of 0·2 per cent., *plus* or *minus* 1 per cent. It must not be forgotten that they were faced with the practical question of getting a unit that could be used commercially. As to Professor Fleming's suggestion that they should follow up Professor Violle's work, it had originally been their intention to do this at the National Physical Laboratory; but he was afraid there was one point which ruled out the possibility of the usefulness of the Violle standard. That was the colour of the light. Suppose one could make an accurate standard of it, the colour of molten platinum was a very red light. It was redder than the pentane lamp; and this seemed to him to rule it out from useful photometry. His impression was it was a great deal worse than the Hefner unit. As to the electric lamp standard, he was second to none as to its usefulness; but they must get it in terms of some other standard. In connection with the question of colour, it seemed to him they were face to face with something that was a physiological problem. One man for some reason would see a red light better than a blue one; and another a blue one better than a red one. The colour problem must be based fundamentally on some form of average value. They must get some eye which might be considered an average eye. He did not know exactly how that was to be done; but on a really wide scale it was possible to attack the problem. If they got a number of men whose colour sight was individually normal, and tested these men very carefully, by letting them observe sets of standards, they were able in this way to get, so to speak, a calibration for each man. They could find out in this way the value that one man obtained for a set of standards differing in colour as compared with another. If one worked these men down by different gradations of colour, the results would help one a great deal to see the value of what one man did as compared with another. He had a primary set of electric standards—some of Dr. Fleming's lamps. They were running at a little over 4 watts per candle, another set 3½ watts per candle, another set at 3 watts, and then they jumped (with metallic filament lamps) down to 2 watts per candle. Supposing they took these lamps (all good standards that had been well seasoned) in different classes, and set upon them six observers, each observer comparing each about six times or so. They were able in this way to get the value of one set of lamps to an accuracy of 0·1 per cent.—that was to say, the probable error was 0·1 per cent. [Mr. Paterson showed two sets of such comparisons on diagrams.] It seemed to him that if they could get a number of observers comparing lamps in this way at the National Physical Laboratory, and in America, France, and Germany, the intercomparison of these standards would give them a good notion as to the average obtained from a whiter light in terms of the pentane lamp. He hoped this would spread the idea that they were not wasting time at the National Physical Laboratory.

Professor SUMPNER (Birmingham) said he would address himself to the question: "What are the best modern methods of obtaining the polar curves of light distribution, and of measuring the mean spherical candle power of different sources, and what possibilities are there of simplifying and improving such processes in the future?" The question seemed to him to divide itself practically into two points: What was the best thing to do with reference to glow lamps; and what was the best thing to do with reference to arc lamps. Practically, it was a difficult matter to get the actual mean spherical candle power in the case of an arc lamp; but it was comparatively easy in the case of a glow lamp. He thought the best way to define the candle power of the glow lamp was by its candle power in the direction at right angles to the filaments. This was an easy test; and it was preferable in the case of glow lamps to use this figure rather than the mean spherical candle power figure. The mean spherical candle power could be obtained by multiplying with 0·8 in all cases. With arc lamps, they had to deal with a distribution that varied in a very complicated sort of way, and also they had to deal with something that was not constant. There were very few arc lamps that were constant for more than a fraction of a second. He ventured to say that, though students at colleges had to work these things out, and although writers of papers showed at great length how people could work them out, he did not think many people did actually do so, because it was very difficult and long. Something was being tested that was not constant; and unless a method could be devised for ascertaining at one measurement the mean spherical candle power, or something upon which it depended, he did not think the mean spherical candle power would ever be taken. He should like to mention the way he tried to obtain the mean spherical candle power of arc lamps some years ago. He found the method rather troublesome; and he offered it merely as a suggestion. In all the photometers that had been described at this meeting, the principle of light being reflected from a white matt surface was used. There was no reason why they should not use the principle twice in photometry. He used it by means of a white surface—such as a screen, or a surface of white drawing paper which did not shine under the action of light, but gave a good diffusing surface. He used a sheet of white paper in such a way that the light received from it in the photometer was a

measure of the mean spherical candle power of the arc lamp. To illustrate the method, he said, supposing the group of lamps there [pointing to those illuminating the hall of the Society of Arts] to represent an arc lamp, and the screen on the wall [the lantern screen] a sheet of white paper, and that this he was going to use as a secondary source of light to measure the mean spherical candle power of the lamps. If they imagined the white paper to be divided into horizontal strips, the light which reached the top strip would be the light measured from the arc lamp in one particular direction; and the light received by the bottom strip the light from the arc lamp in another direction. If the strips were of equal length, they influenced the photometer to different degrees, and generally fairly represented the proportion of light from the arc lamp in different directions. Supposing the arc lamp was throwing off light equal in all directions, then the top strip, being near the arc lamp, would have more light from it, and would possibly influence the photometer more than the bottom strip. But this could be arranged by having the strips of unequal length. They could by calculation design the shape of a sheet which would be opposite the arc lamp at a particular level; and the photometer would then give a measurement which would represent the mean spherical candle power of the arc. Briefly the objects were to obtain a simple method, consisting of a sheet of white paper cut in a special way, put in particular directions and distances with reference to the arc lamp and with reference to the photometer, and so arranged that a single photometrical measurement would measure the mean spherical candle power of the arc lamp. He managed to get good results, though there were difficulties about it. The idea might very possibly suggest modification by others.

Mr. W. J. LIBERTY, invited by the President, said too much importance could not be attached to this question of photometry. At the present time, they were a little bit in the air through the multiplicity of photometers, standards of light, and burners; and the multiplicity tended to confusion. He for one was looking forward to the time when there would be a standard instrument, which would give universally comparable readings. Those who used photometers for street-lamp testing, for instance, knew that if they used one quite different results could be obtained by using another. If a photometer could be devised which all men could employ, the results would be free from suspicion; and there would be more reliability attaching to their work. He believed, however, with the amount of work that was being directed to this subject, they were really coming to something which all would be able to use. There was no doubt about it that photometry was going to play an important part in the question of public lighting in the future.

Professor J. T. MORRIS (East London College) observed that he had worked with different photometers; and he found the grease spot photometer was as satisfactory as any of the others. He got just as accurate results with a well-made grease spot as with the Lummer-Brodhun photometer. But the grease spot must be carefully made. He believed it was best to work with a very small grease spot—to let a single spot of candle grease fall on a good piece of paper, and then remove, while the grease was still hot, the little piece of the spot that would peel off, and then slightly heat the paper over a bunsen flame. Such a grease spot would give as high a degree of accuracy as the Lummer-Brodhun; and it certainly was not so expensive. Regarding the testing of high-power lamps, he had some diagrams of the polar curves of incandescent gas and electric lamps, showing the amount of variation found in the candle power at different angles taken at different times. It was little use measuring the candle power in different directions, and then, having done so, take out the results. One had to make a number of observations, and take the mean of them. Professor Morris showed a number of illumination curves of different lamps. One of them was for the Keith high-pressure inverted gas-lamp. In relation to it, he said that his experience with these lamps was that the intensity of the beam was considerably steadier than that of the electric arc lamp as far as rapid changes were concerned. Next he showed a series of observations with an ordinary hand-feed arc lamp. From these results and a number of others, he was convinced that he could get the mean spherical candle power of such a lamp to within 3 per cent. from each test. Regarding flame carbons (hand-fed), they were not capable of giving such constancy of results, as could be seen by the way the observations were peppered about on the diagram. There was still further difficulty with complete lamps which contain feeding mechanism.



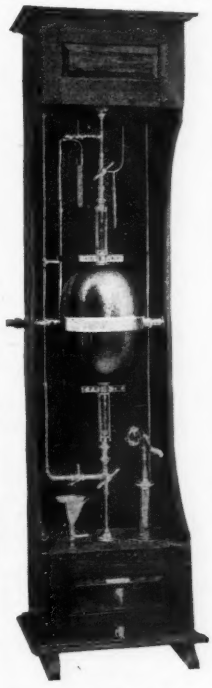
Polar Curve of Distribution of Light of Single Keith Inverted Incandescent High-Pressure Gas-Lamp, having a Double Clear Glass Enclosure. Two Tests. Shade in Position.

Mr. J. S. DOW passed (the hour being late) lightly over a number of communications received from various corresponding members abroad—Dr. Clayton Sharp, Dr. A. C. Humphreys, Dr. Williams, and Dr. Stockhausen. One point on which he dilated was that of the "sensitiveness" of various photometers; and, in the course of his remarks, he mentioned that experiments he made some time ago showed that the sensitiveness of certain photometers would vary with the degree of illumination.

The PRESIDENT remarked that one thing had come out clearly, and that was that the subject was much too big for one evening's discussion. This was not astonishing when they considered that the Society had entered a field largely unworked by other societies.

MOUNTED CUBIC FOOT BOTTLE.

On the occasion of the meeting of the New York Section of the Society of Chemical Industry at which Dr. Elliott, of the Consolidated Gas Company, read a paper describing the apparatus used by him for testing gas, as noticed last week, p. 663, Mr. E. C. Uhlig, the Chemist of the Citizens' Gas Company, directed the attention of members to a mounted cubic foot bottle for calibrating volumetric gas-testing apparatus. It is shown in the accompanying illustration, for which, as well as for the following particulars, we are indebted to the "Journal" of the Society and its Editor (Mr. Watson Smith).



The bottle consists of an oval copper vessel joined at the top and bottom with water-tanks. These tanks are of wood, metal lined, and are connected with each other directly by piping. At the bottom there is a pump which enables the water to be forced from the lower to the upper tank. There is a funnel on the lower tank, through which water may be added, and a cock by which it may be drawn off. Immediately above and below the copper vessel are two small wooden shelves, which are fastened to the wooden back of the instrument, running from the upper to the lower tank, and binding the whole together. The pipe leading from the copper vessel both above and below is all glass for about 6 inches, and on these glass portions are marked the upper and lower limits of the cubic foot. Six inches above the upper glass tube are a three-way cock and a small tube which permit the escape of air. Above this is a valve by which the cubic foot may be shut off from the apparatus under test; and there is a similar valve below the copper vessel for controlling the flow of water from the upper tank to it. There is also a three-way cock connecting with the lower tank, the pipe, and the vessel above.

This apparatus is standardized and certified by the Bureau of Standards at Washington. By its means a cubic foot of air or gas can be passed through the outlet connection; and by repeating the operation any number of cubic feet may be passed.

Extension of High-Pressure Gas Supply in the City.

At the meeting of the Court of Common Council of the City of London last Thursday, the Streets Committee submitted a report in regard to an application by the Gaslight and Coke Company for permission to extend the high-pressure main from Ludgate Circus along Farringdon Street and Seacoal Lane to a point about 100 feet north of the railway arch, and recommended that no objection be offered to the proposal, subject to the work in Ludgate Circus being commenced on a Saturday afternoon, and carried on continuously by day and night until completion, and no part of the main being laid or constructed over the public sewers, and otherwise to the regulations. The recommendation was agreed to. The object of the Company in making this extension of their high-pressure main is to meet the demand of the large printing and publishing premises of Messrs. Cassell and Co., Limited, who require the power for trade purposes.

Private Bills and Orders of the Session.—According to the usual report by the Board of Trade on the Private Bills and Provisional Orders of the session, the total number of the former is 89, of which 30 are for gas and 22 for water; the capital proposed to be raised being £1,386,865 and £2,170,466. Applications have been made for 55 Provisional Orders—15 in respect of gas, 5 of water, and 25 of electric lighting; the proposed capital being £394,251, £89,166, and £86,998.

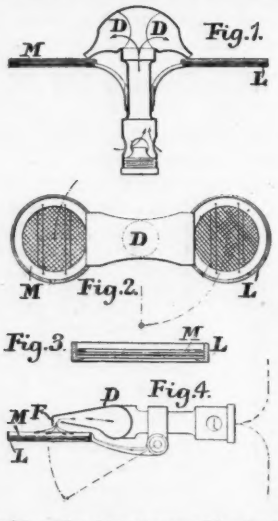
REGISTER OF PATENTS.

Incandescent Gas-Lamps.

BOURRELLY, G., and LABRY, A., of Paris.

No. 1531; Jan. 21, 1909. Date claimed under International Convention, Jan. 21, 1908.

A lamp made in accordance with this invention comprises a flat luminous body and a burner orifice which is substantially rectangular, is narrow, and very long—that is, of "a length practically equal to the width of the luminous body, and is so arranged as to give a broad, flat, and thin flame which spreads over the whole of the luminous body."



A Gas-Burner with a Flat Incandescent Disc (instead of Mantle).

Fig. 1 shows in section a complete burner with two flat discs; and fig. 2 is a plan. Fig. 3 shows in cross section (to a larger scale) a complete flat disc carrier. Fig. 4 shows, in elevation and section, a burner for one or more flat discs; the gas being brought to the injector from above or below.

In figs. 1 and 2, the gas, on issuing from the burner injector, sucks in a quantity of air necessary for combustion; and the mixture rises into the chamber D, and passes out through the rectangular orifices. "The flames thus produced are flat, thin, and very hot (blue flames). They will, of course, come into contact with the whole surface of the flat disc, which will be brought to a dazzling incandescence."

In fig. 3 is indicated the method of supporting the disc; the carrier having two small platinum wires for the purpose. The ring or crown M also carries two small platinum wires for preventing the buckling of the disc during incandescence. In order to put the disc in place, therefore, it is sufficient to drop it on to the disc carrier L, and then to place the crown M over it.

In fig. 4, a horizontal burner is shown. In this case, the outlet orifice for the blue flame is always of rectangular section; but in order that the issuing flame may entirely cover the flat disc, the end of the surface F is turned in such a way as to direct the flame downwards.

Production of Incandescent Light by Generator Gas.

ERNST, E. U. G., of Frederiksberg, Copenhagen.

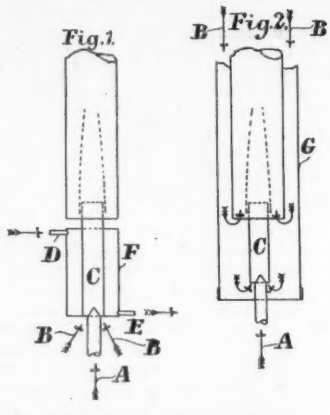
No. 4361; Feb. 22, 1909. Date claimed under International Convention, March 12, 1908.

This invention relates to the production of incandescent light by means of generator gas and the like—in fact, any gas which, rich in nitrogen alone, is not considered applicable for lighting purposes. In the text-books thereon, the patentee points out, complaints are often made of this state of things. It has been investigated, among others, by Pfeifer ("Heating Gas and its Application;" Munich, 1901), who made experiments both with albo-carbon lamps and with Welsbach gas-lamps. The first-named lamps would not light at all, and the others would not give light at ordinary pressure. It was only when the pressure exceeded 50 mm. that light was emitted with an intensity equivalent to 11-candle power. The consumption came to 600 litres per hour, or more than double the amount that would be consumed if the gas were used as a source of power in an electric installation for producing incandescent light of the same quality.

It has, in consequence, been proposed in incandescent lighting to mix generator gas, previously passed through the products of combustion, with air and oxygen; the oxygen also having been previously passed through the products of combustion. Also it has been proposed in producer or water gas burners to heat the air, before mixing it with the producer or water gas, in order to obtain a better light, by passing it over the surfaces of hoods arranged over the usual air inlets of the bunsen burner and deriving their heat by conduction from the burner. But according to this invention, generator gas or the like is consumed with air only, so that the percentage of nitrogen is not reduced, as would be the case if pure oxygen were added, and such a degree of heat is imparted to the mixture by heating either the air or gas (or both) that the temperature of the flame, which is low in itself, is raised beyond a certain limit which is critical, and below which no practical light emission takes place.

This leading idea of the invention will be more easily followed on referring to the following example: Assuming that the available temperature of the flame of the gas rich in nitrogen may be about 900° or 950° C., while the temperature of the light emission of the mantle in a number of practical experiments may be reckoned to be at least 1000° C., it will be found that the temperature of the flame must be raised 50° to 100° C., or more, in order that this kind of gas shall be applicable in glow lamps.

The experiments made by the patentee have confirmed the correctness of this assumption; and they are shown diagrammatically in two examples.



Ernst's Generator Gas Incandescent Burner.

When generator gas or the like (indicated by the arrow A) and air (arrows B) are passed through the burner-tube C, fig. 1, and burn in the usual manner on the mantle, no emission of light will at first take place, but at most a shining zone will appear on the lower part of the mantle. But if steam (arrows D and E) be passed through the jacket F, then light is emitted. The same effect is obtained if the regenerator glass chimney G is put on as shown in fig. 2.

The mode of preheating is, on the whole, of no importance. "The mixture of gas and air may be preheated, or the air alone, or the gas alone, and the gas does not require to be mixed with the air before the ignition. Furthermore, the degree of preheating may be made much higher than above assumed; but such a further heating is in itself not characteristic of the invention, because the latter is distinguished from the known application of lamps with preheating or regenerative effect—that is to say, with purely quantitative increase of an already existent effect—thereby that a flame temperature low in itself is raised beyond a certain limit, which is critical, while practically speaking no light emission takes place below this limit. By the stated small increase of temperature of the flame a real change of quality sets in, together with an accompanying disproportional great rise in the intensity of the light."

Radiating Ascension Pipe for Gas-Retorts.

TOWNSEND, W. W., of Hereford.

No. 4709; Feb. 26, 1909.

Townsend's Radiating Ascension Pipes.

The patentee's proposal is to so construct the ascension pipe as to dissipate the heat of the gas as quickly as possible, "in order to prevent or minimize stoppages in the pipe." The invention is said to be particularly advantageous when used in connection with a system of dry collecting mains and "anti-dip" valves; the gas being "cooled to such an extent in passing up the pipe that no stoppage occurs in the valve or in the dry collecting mains."

As shown, the ascension pipe is made with a number of longitudinal radiating ribs F running almost the whole length of the pipe on the outside, and cast in one with the pipe. The size of the ribs may be varied to suit requirements; "but the total area of the surface of the ribs should be as large as possible." An alternative way of carrying out the invention is to form stud-like pointed projections all over the exterior of the pipe.

The principle of the invention is, "that the hot gas issuing from the retort should be cooled as soon as possible, and this is effected by making the ascension pipe as described, which increases its radiating surface very considerably."

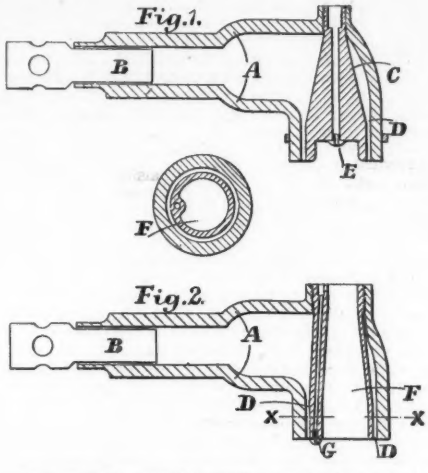
Inverted Incandescent Gas-Burners.

BROWNING, E. M., of Buckhurst Hill, Essex.

No. 5963; March 12, 1909.

This burner (connected to an ordinary mixing-tube) has a solid cone-shaped body passing through its centre, with its base parallel with the lower end of the burner, and slightly smaller in diameter. The annular space thus formed between them is the point of ignition, and the point of greatest resistance to the flow of gas and air through the burner; so that any tendency to light-back is reduced, and the necessity of the use of gauzes is obviated. The burner-head, of course, becomes heated; and the temperature of the air and gas mixture passing through it to the point of ignition is raised, and increases the velocity at which the mixture is consumed. This preheating of the gaseous mixture is further assisted by the cone-shaped body, retaining the heat of the burning

gas. In a modification filed, there is substituted for the solid cone-shaped body a hollow passage, which extends throughout the burner-head, allowing part of the products of combustion to pass through the centre of, as well as around, the burner-head, and thus providing a larger heating surface to the body over which the gaseous mixture has to pass before reaching the point of ignition.



Browning's Inverted Incandescent Gas-Burner.

Fig. 1 shows the burner-head with the solid cone-shaped inner body; and fig. 2 the hollow cone-shaped body. This plan is through the line X of fig. 2. A is the head of the burner which forms the superheating chamber; and B is the ordinary mixing-tube, which may be of any suitable dimensions. C is the solid cone-shaped body screwed to the burner-head; D is the annular space formed between it and the lower end of the burner. There is a central gas-way or passage through C. E is a small burner at the lower end of the gas-way for supplying the ignition jet. As shown, there is an enlarged space within the base of the cone serving to protect the jet from draughts.

In fig. 2, the hollow cone-shaped body has a centre flue or passage extending through the top of the burner-head. Here G is the bye-pass to the ignition jet.

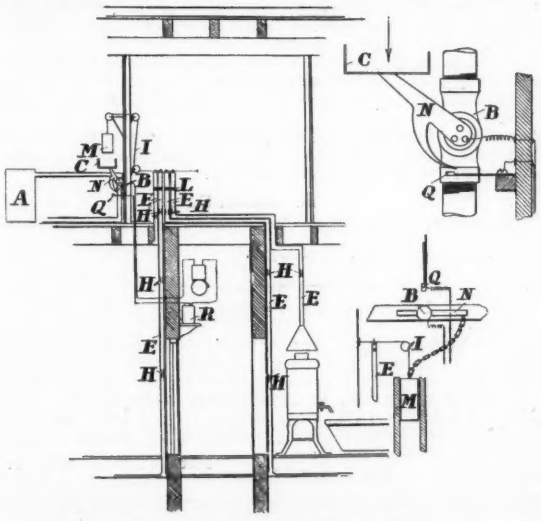
Signalling an Escape of Gas.

VAN DE KAMP, W. A. J., of Haarlem, Holland.

No. 9487; April 21, 1909.

This invention relates to apparatus "for preventing explosions and obviating the risk of poisoning, for reducing the waste of gas due to its unintentional escape from pipes in buildings and closed rooms, and for giving warning of the accumulation of dangerous gases."

Various means, as the patentee points out, have been devised to obviate these risks, and at the same time to decrease the amount of gas which can escape in buildings, by causing the gas escaping from a pipe without ignition automatically to turn off the main gas-cock, and actuate an alarm signal. In other cases, the escaping gases have been caused to pass over an igniting means—such as platinum sponge or the like—and a fusible filament or wire suspended above the igniting means is caused to fuse by the flame produced and thus set in operation a device that effects the closing of the main cock and actuates an alarm signal.



Van de Kamp's Gas-Leakage Indicator.

The operation of the apparatus shown is as follows: The gas passes from the outer piping through the meter A into the house, and, after passing the main cock B, is distributed to the various rooms. Within the building there are arranged special pipes E, the lower orifices of which are funnel-shaped so as to catch any unignited gas escaping. These pipes are so arranged that the orifice of each is either at the highest point of the room where the gas would accumulate or directly over the spot where the escape would occur—as, for instance, in a bath-room over the geyzer. In the upper orifices of the pipes E are igniting pellets of platinum sponges and the like. Should gas now accidentally escape, it will be caught by the pipes E, and render the ignition pellets incandescent so as to become ignited thereby. To avoid the possibility of the flame produced by the ignition pellet flashing back into the pipes, they are provided close to the outlet orifice with a wire gauze L; while arranged within the pipes safety devices, such as small glass tubes H, are placed.

By means either of the flame or of the ignition pellet, the cord I, put in tension by a weight M, is fused, whereupon the weight falls, and either directly (as shown in the details) or by means of intermediate mechanism, such as a tray C on which the weight falls, rocks the arm N of the main cock, and thus cuts off the gas supply. The lever arm N is provided with a projection which, when the arm is rocked, makes contact with a spring Q, and thereby closes the electric circuit of a bell or other alarm signal.

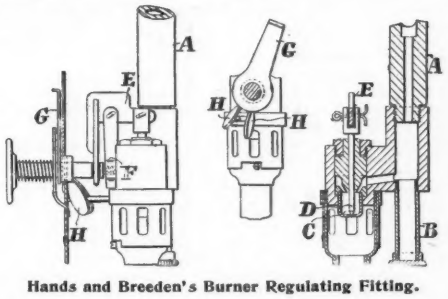
In the first arrangement shown, an electric battery R is connected with the bell S. By the closure of the cock of the main supply pipe "further loss of gas is prevented, while the occupants of the buildings are warned by the sounding of the signalling device of the fact that gas is escaping—the ignition pellet coming into action long before there is any real danger to the occupants."

Incandescent Gas-Burner Fittings.

HANDS, G., of Farringdon Road, E.C., and BREEDEN, F., of Moseley, Birmingham.

No. 1594; Jan. 21, 1910.

According to this invention, the lever for operating the valve of a gas-lamp is a bell-crank lever which acts directly upon the gas-control valve, is supported upon the burner-fitting, and is under the control of a screw screwing into the burner fitting.



Hands and Breeden's Burner Regulating Fitting.

The illustration shows an elevation of the burner fitting, a central vertical section taken through the burner-tube and supply pipe, and an elevation of the air-regulating device.

The pipe A, for the supply of gas to the mixing-chamber of the burner, is provided with a removable dust-trap—a short length of tube B. Just above the trap there is a lateral passage for conducting the gas to the mixing-chamber. To regulate the size of the orifice in the nipple C, and at the same time to permit of clearing the orifice in case it should be choked, there is a small valve D, preferably conical or of the needle type, adapted to seat in an orifice similarly formed. The spindle of the valve is connected to one arm E of a bell-crank lever the fulcrum of which is formed by a split pin passing through two perforated lugs mounted on the duct leading to the mixing-chamber. The other arm of the lever has a fork, which takes into a groove F in a screw passing through a hole in a boss and provided at one end with a milled head.

To regulate the amount of air passing into the mixing-chamber, the latter is provided with the usual perforated revoluble sleeve, which has a rigid arm or projection on it. Mounted in a hole in the casing is a lever G, of the double-armed type, one arm of which serves as a handle, while the other arm H is forked and adapted to embrace the projection on the sleeve. The boss or fulcrum of this lever is perforated, and the screw employed to regulate the gas-valve D in the nipple passes through it and into the internally screwed hole in the boss or lug on the lateral branch pipe forming part of the casing of the valve for admitting gas to the nipple.

New Reservoir for Tiverton.—There were 22 tenders received by the Tiverton Town Council for a new reservoir and other works of water supply. Eight of them were for both solid and reinforced concrete, and six for reinforced concrete only. The Water Committee decided to have the work carried out in solid concrete, and accepted the tender of Mr. E. G. Coles, of Taunton, for £2278.

Increased Cost of Public Lighting at Newport (Mon.).—A reduction of 2d. in the pound in the rates at Newport (Mon.) having been announced, the Secretary of the Ratepayers' Association (Mr. J. P. Elms), in a letter to a local paper, remarks that, while this relief will be welcomed by the ratepayers, the most cursory examination of the estimates will show that the diminution is due to adventitious circumstances, that the ordinary expenditure on revenue account is still advancing by leaps and bounds, and that unless economy is practised there will be a great increase in the rates at no distant period. Among the increases in one year Mr. Elms mentions £700 for street lighting, which he characterizes as "a monstrous charge," and evidently the result of replacing gas by electricity, and of having the same Committee in control of the public lighting and the electricity works. He points out that for the year ended March 31, 1901, the charge for public lighting was £4771; whereas for the year ending March 31, 1911, it is estimated at £7900—an increase of about 66 per cent., against an increase of a little more than 20 per cent. in the population of the borough.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Phenomenon of Flame.

SIR,—With reference to Dr. Colman's lecture before the Southern Junior Association at the Cripplegate Institute, I find the source of the ideas to which I tried to give expression to be an address to the Chemical Section of the British Association delivered by Professor Arthur Smithells in 1907; the subject being "The Phenomenon of Flame." I enclose an extract from it.

Though it is made evident that this knowledge was not new at the date of the address, I am inclined to think that it is still more or less unfamiliar to some of us who are concerned with flame temperatures. This is probably to be explained by the fact that, though doubtless of great scientific interest and significance, it is not—as appears from Dr. Colman's reply to my question—of much, if any, practical importance to the gas industry.

Whether under these circumstances, it is desirable that the extract should appear in the columns of the "JOURNAL" I leave, of course, to your decision.

A. F. BROWNE.

South Metropolitan Gas Company, Vauxhall, S.E., March 21, 1910.

[ENCLOSURE.]

PROFESSOR SMITHELLS ON THE PHENOMENON OF FLAME.

Annual Meeting of the British Association held at Leicester, July 31, 1907.

One of the first questions to meet us in the study of flame is that of the temperature at which, in any given case, the phenomenon becomes evident. Here, I think, a great clarification of view has taken place. The old idea that there existed a fixed temperature at which inflammation suddenly took place cannot now be maintained; and the term "ignition temperature" has acquired a different meaning. It is now known that in a very great number of cases a mixture of two flame-forming gases, when gradually raised in temperature, will develop luminosity quite gradually *pari passu* with the chemical combination that is being induced. This phenomenon is, of course, known universally in connection with phosphorus; but it is not so widely known in connection with other combustible substances. I do not know how many times the independent discovery has been made that sulphur, arsenic, carbon disulphide, alcohol, ether, paraffin, and a whole host of other compounds, inorganic and organic, will phosphoresce as truly as phosphorus itself—that, in fact, phosphorescent combustion is the normal phenomenon antecedent to what we ordinarily call flame.

This is, after all, only in harmony with the general truth that chemical combination between two gases does not set in suddenly, but comes into evidence quite gradually as the temperature is raised from a point at which the action, if it occurs at all, is so slow as to be negligible. The change from phosphorescence to ordinary flame is not sudden; but the appearance of ordinary flame is the end-point of a continuous, though rapid, development. This end-point is the temperature of ignition. What, then, determines the temperature of ignition? The answer to this question has been given with characteristic conciseness by Van 't Hoff as "the temperature at which the initial loss of heat due to conduction, &c., is equal to the heat evolved in the same time by the chemical reaction."

Official Testing of Meters.

SIR,—With your permission, I would add further to my previous observations in the "JOURNAL," on official testing of gas-meters, published Sept. 28 last. I believe that my remarks will be of interest to those who have read that part of the recent addresses of the Presidents of the Manchester District Institution of Gas Engineers and the Southern District Association of Gas Engineers and Managers, relating to the unsatisfactory registration state of dry meters and the law regulating their use in the sale of gas.

Both Mr. Ellery and Mr. Kendrick confirm much of what I set forth. Mr. Kendrick goes so far as to declare that the new meters he had tested were nearly as bad as the old ones. This is matter for the serious consideration of the district in which they were stamped—especially seeing that the old meters were tested straight from the district. The law provides that a 3-light meter shall not be stamped until it has been found to register any amount between 0·9 and 0·5 cubic feet per hour, under penalty for default.

Undoubtedly the specification of a fixed pressure and a fixed rate per hour with the testing of meters for accuracy of registration is now out of date and appears absurd. The results are not satisfactory to anyone concerned. A buyer or a seller of gas does not really know which party obtains the advantage or disadvantage with a meter that varies in registration at different rates of working. Meters are seldom worked at the rate per hour they are officially tested at. It is confirmed that meters are fixed to pass any rate per hour from the smallest amount to as much as may be demanded. The law prohibits gas consumers using meters beyond the badged rate per hour; but even supposing that this was carried out in practice, a consumer is not supposed to always work the meter at the full load at which it was officially passed as correct. Meters that would register small rates correctly, and also register correctly at their badged rate per hour, do not register incorrectly at rates per hour beyond the badged rate—that is, as regards dry meters. Wet meters may register small rates correctly, and also register correctly at their badged rate per hour, but if worked at rates beyond their badged amount per hour, they may register most seriously incorrectly.

The only apparently reliable method of testing wet meters for varying registration with dispatch is to test them at increased rates about double that of their badged amount, or (say) 3 inches of water pressure, with the outlet conditions remaining the same as for the badged rate per hour at five-tenths of an inch of water pressure—the basis of capacity being that of 6 cubic feet per hour per light, or 120 revolutions per hour. Where meters register correctly at different rates of working, there is no injustice in fixing them to work at rates beyond their badged amount per hour, only to the manufacturer who guarantees them for a stipulated period. Increase the pace, and you shorten the life disproportionately.

The more serious consideration is that meters so worked soon become impaired; not only as regards life, but as regards accuracy of registration. I have known of from 40 to 60 per cent. of meters of different makes rejected as incorrect within two years of stamping. The official seal is not long evidence of accuracy of registration in such cases; and there is no provision whereby meters are to be periodically verified. It has, however, appeared reasonable that meters should be officially tested at different rates of working, and that the more expeditious method would be to test at the increased rate. There are many meters that do register correctly at different rates even to an extraordinary extent; and were it not for the specified conditions under which the Sales of Gas Act rules require accuracy of registration to be ascertained, Section 12 would enable inspectors to refuse to stamp meters that were capable of incorrect registration by means which are practically prevented in good meters.

Reverting again to the testing for the passing of unregistered gas in meters, the London County Council have resolved that the test is unnecessary with new meters, and greatly delays the work of testing stations. ["JOURNAL," Nov. 27, 1906.] I agree that the time taken up with the test is considerable; but I think the importance of the test warrants even the more stringent and lawful test being applied. There would be no official guarantee or safeguard that even new meters were as sound as formerly; whereas they are now looked upon as far from satisfactory in this particular respect. The stringency of the tests inferred by the experiments put forward by Mr. Ellery and Mr. Kendrick could only at considerable cost be officially applied.

All parties concerned have their own particular views, which only goes to show how necessary it is that the matter should be well thrashed out, especially as no one appears satisfied with the present conditions. Regulations based on a new or amended law appear necessary by which practicable accuracy and uniformity of practice with the testing of meters would be ensured. To my official mind, the chief defects of the present law and system are the fixed rate and pressure at which the accuracy of registration is ascertained, the extremely wide range in rate at which many meters are permitted by law to be tested for the passing of unregistered gas, the absence of facilities for ascertaining the correctness of the index registration, and the need of some provision whereby meters would be systematically submitted for reverification.

F. COE.

Nottingham, March 18, 1910.

Gas Engineering Section at the Japan-British Exhibition.

SIR,—Having accepted the chairmanship of the Gas Engineering Section of the Japan-British Exhibition, which opens at the beginning of May next, under the auspices of the Imperial Japanese Government, I am asked by my Committee to state that they are extremely anxious that the gas engineering exhibits from Great Britain should be such as to show the high position occupied by us in this important branch of engineering.

The Organizing Committee have made arrangements whereby gas will be available for use in connection with working exhibits; and I am venturing to address this letter to you with the object of bringing before your notice the importance of showing our allies the splendid field which exists for opening out a market in this direction.

I, therefore, hope—not only for reasons mentioned above, but with a view to ensuring that the Gas Engineering Section in Great Britain should be represented in a manner worthy of its eminent position—that you will recognize the importance of having a display worthy of the occasion.

I should like to call particular attention to the large number of very eminent Englishmen who are interested in this exhibition, which interest is shared, one might almost venture to say, in a still larger degree by the Japanese nation and Government. As evidence of this, I would inform you that this nation have taken half the space in the exhibition and the surrounding buildings. In fact, the exhibition has become quite a paramount consideration with the Japanese, who appear to be putting aside all their own exhibitions in order to concentrate their efforts upon making the greatest possible display of Japanese industries ever seen out of their own country.

It is very probable that the Japanese nation have made little or no advance in the direction of gas engineering; and it behoves us, therefore, to exercise every endeavour to make this section an absolute success.

Personally, I look upon the Japanese not only as our allies, but as the "Englishmen of the East" with whom in future we are likely to have much closer relations than even in the past.

H. GRAHAM HARRIS,
Chairman, Gas Engineering Committee, Japan-British Exhibition.

Shepherd's Bush, W., March 18, 1910.

The "Pax" Patents.

SIR,—In thanking you for the very clear and comprehensive manner in which you have been good enough to describe the inventions shown here last week, may we ask you to place us still further in your debt by pointing out that Mr. P. Currall Pace is the inventor of the "Pharoso" system of gas lighting, heating, and cooking by petrol, but is not (as your article would convey) the inventor of the angle bracket light nor of the "Pax" switch.

John Street, W.C., March 17, 1910. PAX PATENTS COMPANY.

In an article on "Fog-Free London" in the "Daily Mail" on Monday last week, the question was asked: "How has London acquired its immunity?" and the explanation is given: "The introduction of gas-fires and gas-cookers, electrical heating apparatus, and the systems of water heating installed in so many City buildings, has an important bearing upon the problem of the lost fogs. Half-a-million new gas fires, cookers, and heaters have in recent years been introduced into London."

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read a second time and committed: Cambridge Water Bill.

Bills reported: Bishop's Stortford, Harlow, and Epping Gas and Electricity Bill; Farnham Gas and Electricity Bill; Wicklow Gas Bill.

The opposition to the Southend Water, Thorne and District Water, and Wicklow Gas Bills has been withdrawn.

The Gas Companies Standard Burner Bills (Nos. 1, 2, and 3) have been referred to a Select Committee, consisting of Lord Joicey (Chairman), Lord Willoughby de Broke, Lord Vivian, Lord St. Levan, and Lord Ritchie; to meet on Thursday, April 7.

The Matlock Bath and Scarthin Nick Urban District Council Bill has been referred to a Select Committee, consisting of the Duke of Northumberland (Chairman), the Duke of Wellington, the Earl of Lindsey, the Earl of Harewood, and the Earl of Lovelace; to meet on Tuesday, April 5.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Glasgow Gas Consolidation Bill, Mallow Gas Bill, Mountain Ash Water Bill, Wishaw Burgh Extensions, &c., Bill.

Bill reported, with amendments: Brighton and Hove Gas Bill.

After the second reading of the Mountain Ash Water Bill, it was ordered, on the motion of Mr. Stanier (Newport), that the Committee on the Bill be instructed that they have power to inquire whether the promoters have made adequate provision by the Bill for the supply of water at reasonable rates to the agricultural community within the area of supply, and to any person or persons from whom any existing or natural supply is, or may be, withdrawn owing to the works or undertakings authorized by the Bill; and that they further have power to insert in the Bill such clause or clauses as they think necessary to impose upon the promoters the obligation to provide such supply.

In answer to a question by Mr. Kenneth Foster (Coventry), as to whether any action is contemplated by the Government, in view of the recommendations of the Royal Commissions on Water Supply (1869), Salmon Fisheries, and Sewage Disposal, and of the representations made to him by the County Councils' Association in 1903 and the Metropolitan Water Board in 1907, in reference to the appropriation and regulation of catchment areas for public water supplies, Mr. Burns said the matter was engaging his attention in connection with a Bill which would shortly come on for consideration in another place.

Last Thursday, Mr. Salter (Basingstoke) asked the Secretary of State for War: (1) What was the distance to be covered in each case by the proposed extension of the Aldershot electric lighting installation to the camps at Deepcut, Blackdown, and Ewshott, and whether, in view of the fact that the gas-mains of the Aldershot Gas and Water Company are in close proximity to the camps named, he had considered the possibilities of utilizing their system; (2) what was the estimated cost per unit for the supply of electricity to the camps, and whether he had obtained any tender from the Aldershot Company for the supply of gas to them in lieu of electricity, and, if so, whether he would state the price per cubic foot [*sic*] for which the Company were willing to supply it; and (3) whether, in view of the cost of the proposed extension of the electric lighting installation to the camps, a considerable saving might be effected, both in first cost and current expenditure, by utilizing the system of the Aldershot Gas and Water Company, especially having regard to the fact that the use of gas for heating and cooking purposes would save the necessity of carting quantities of coal to these camps at great expense. In a written reply, Mr. Haldane said: The distance to Deepcut is 5½ miles, and a further three-quarters of a mile to Blackdown; that to Ewshott is 3¾ miles. The question of using the gas supply from Aldershot has been considered, and it has been decided that it would be more economical to extend the War Department's electric light installation, which will also provide a more satisfactory illuminant. The Aldershot Gas Company tendered; but their price is presumably confidential. The cost of the electric lighting is an estimate, and cannot at present be disclosed.

The New Gas-Works for Belfast.—At an adjourned special meeting last Wednesday, the Belfast Borough Council passed the following resolution: "That the experts' report called for on Oct. 4, 1909, having now been presented, the site known as the Twin Islands site, appearing to be the most advantageous offered, be selected for the proposed auxiliary gas-works; and that the Gas and Law Committees be authorized to take the necessary steps to acquire it." The experts' report here referred to, it may be pointed out, was reproduced in the "JOURNAL" for Feb. 15 last (p. 454).

San Paulo Gas Company, Limited.—The Directors report that for the year 1909 the profit was £44,678, to which is added £838 dividends on investments, and £6432 brought forward; making a total of £51,959. After transferring £5000 to reserve account, and charging £3000 for part cost of a small gasholder which is no longer serviceable, and £2000 for the renewal of the Company's tramway, they recommend a further dividend on the ordinary shares of 6 per cent., tax-free, making 9 per cent. for the year; and leaving a balance of £6561 to be carried forward. The total number of public lamps at the end of the year was 5818, an increase of 598; and the quantity of gas consumed in the public illumination was 10 per cent. more than in 1908. The use of gas by private consumers continues to increase, notwithstanding the keen competition from electricity; the quantity sold last year being, in the aggregate, 10 per cent. in excess of that of 1908.

BRIGHTON AND HOVE GAS BILL.

House of Commons Committee.—Tuesday, March 15.

(*Before the Hon.* ARTHUR STANLEY, *Chairman, Mr.* HENRY, *and Mr.* GUINNESS.)

The object of this Bill is to confer additional powers on the Brighton and Hove Gas Company, including authority to provide a redemption of capital fund with which to write off capital in respect of disused and abandoned works, and the adoption of the "Metropolitan" No. 2 argand burner.

Mr. BALFOUR BROWNE, K.C., Mr. HONORATUS LLOYD, K.C., and Mr. CLEASE appeared for the promoters. The petitioners in opposition were represented as follows: Brighton Corporation, by Mr. G. J. TALBOT, K.C., and Mr. HUTCHINSON; the Portslade-by-Sea, Southwick, and Shoreham Urban District Councils, by Mr. VESEY KNOX, K.C., Mr. TYLDESLEY JONES, and Mr. JOHN FLOWERS; the Hove Corporation, by Mr. A. J. RAM, K.C.; and the East Sussex County Council, by the Hon. EVAN CHARTERIS. On behalf of the West Sussex County Council, Counsel was reserved.

Mr. BALFOUR BROWNE, in opening, said, so far as he knew, there was really no opposition to the preamble. Certain clauses were, however, objected to by petitioners.

Mr. RAM said he could not assent to the statement that there was no preamble opposition. So great was his opposition to certain clauses, that unless they were largely modified—if indeed they were not entirely altered—he should certainly ask the Committee to throw out the Bill.

Mr. BALFOUR BROWNE, continuing, said he believed that really a little modification of certain clauses would satisfy the whole of the opponents. The Company was incorporated in 1839, and had obtained various Acts of Parliament since. The capital now stood at about £700,000. In the inner area of supply, which covered Brighton and Hove, the standard price was 3s. 3d. per 1000 cubic feet, and the price actually charged was 2s. 11d. In the outer area, to the north and west of Brighton and Hove, the charge was 6d. more; and in the area further to the west and in the east, the charge was 1s. more. The Company had been away from Parliament since 1893. Most of the facilities now sought were in the Model Bill; and if the Brighton Bill passed in its present form, it would bring their statutory powers into line with modern practice. The principal clauses to which exception was taken were those relating to the creation of a special purposes fund, and to the incorporation with it of the insurance fund; to the provision of a redemption of capital fund; to the carrying forward of sufficient money to pay one year's dividend; to the adoption for testing purposes of the "Metropolitan" No. 2 argand burner; and to certain reductions in the power of charging for gas. The clause regarding the special purposes fund was in accordance with the Model Bill. As to the clause enabling the Company to increase the carry-forward, originally companies could carry forward very large sums; and this was one of the first companies to which restriction was applied—the limit in their case being £15,000. The interest of the consumers was best served by the price for gas being fixed instead of varying from time to time; but with such a small sum as could now be carried forward, the Company would not be able to tide over a period when the conditions were temporarily bad. Clause 11, which provided for the redemption of capital, was a new proposal; and reason for it would have to be shown. The true principle in any undertaking of this sort was that the dividend should relate merely to effective capital. The Brighton Company had on two separate occasions abandoned certain of their works. In 1870, they were forced to abandon works in Hove and to remove to Portslade; and in 1884, on an amalgamation of two Companies taking place, the manufacture of gas at the Black Rock works was discontinued. The result in each case was that a large amount of capital was left on the Company's hands. The amount of capital that was obsolete was something like £57,000. Of course, interest had to be paid on this; and while it remained obsolete and unwritten off, the Company would have to charge a price for gas which would enable this interest to be paid. In these circumstances, the Company thought it would be a good plan to form a capital redemption fund to pay off the obsolete capital. But the fund was limited so that, whenever the Company's capital had been reduced to an amount equalling £500 per million cubic feet manufactured, the writing-off would cease. The Committee which sat in 1899 under the presidency of Sir James Rankin recommended that "efforts should be made, by any company having obsolete or unproductive capital, to redeem such capital by a sinking fund or otherwise;" and in 1903 a clause was inserted in a Bill promoted by the Gaslight and Coke Company enabling them to write off unremunerative capital. The Brighton Company proposed to do the same, by purchasing preference stock in the market and cancelling it—thus getting rid of the burden which they now had to bear. The clause was new and important; but it was justified by the report of the Committee to which he had referred, and by common sense. It would inure to the benefit of the consumers, because at present they were paying for an instrument that was not effective, whereas in the future they would pay for an instrument that was effective, and that was sound economy. By clause 19, the No. 2 "Metropolitan" argand burner would be adopted. The No. 1 argand had been given up in London entirely. It was the burner prescribed by the Brighton Company's Act of 1903; and it was approximately a fair burner for testing coal gas. Now, however, that carburetted water gas was mixed with coal gas, it did not give a reasonably accurate test, because the compound gas required less air for its combustion than coal gas alone. At present, in order to satisfy the defective and inaccurate testing of the No. 1 argand, the Company had to supplement the illuminating power and keep it in excess of statutory requirement. The proposed burner was specified in the Model Bill, and it was prescribed by the London Gas Referees and, whenever possible, by the Board of Trade. So far as the Company knew, the change was not of importance to the consumers; but, if adopted, it would relieve the Company from the necessity, in order to guard against the uncertainty of the present test, of providing a large margin in the illuminating power. The projected

reductions in price were designed to encourage consumption, which, in the outer areas, was at present very small. The Brighton Corporation in their petition stated:

By clause 11 of the Bill, it is proposed to authorize the Directors of the Company to appropriate half yearly, out of the revenue of the Company, an amount equal to ¼ per cent. on the paid-up capital of the Company (including premiums and moneys borrowed on capital account) for the purpose of the formation of a capital redemption fund, and to apply such fund in purchasing ordinary or preference stock of the Company for the purpose of cancellation. Your petitioners strongly object to the powers sought by such clause, and submit that the same are entirely novel, unprecedented, and unjustifiable. The operation of such provisions would be very prejudicial to the interests of the consumers of gas in the borough, and would, or might, prevent or retard the reduction in the price of gas; and your petitioners submit that the powers sought by such clause should not be sanctioned.

While this proposal was novel, it was not unjustifiable. It must tend to reduce the price of gas; for the less capital there was to pay interest on, the less the consumer would have to be charged. The petition went on to object to the provisions of clause 16 as to the price of gas and the dividends payable by the Company on their ordinary capital:

Your petitioners would desire to point out in this connection that the standard price of gas on which the dividends payable by the Company was regulated was fixed so long ago as the year 1881, and your petitioners submit that such price is not justified under the existing conditions, and having regard to the present position of the Company. Your petitioners further object to the proposals of such clause with reference to the increase and reduction in the dividends payable by the Company, and submit that such provisions should be altered by providing that the dividends in respect of the capital of the Company which only bears 7 per cent. should be reduced or increased by the sum of 3s. 6d. per year, or 1s. 9d. per half year, in lieu of the proposed increase or reduction of 2s. 6d. per half year. Your petitioners accordingly submit that the clause should not be sanctioned in its present form, and that amendments should be made therein in respect of the above-mentioned matters.

This, perhaps, was the most important clause in the petition. All the capital of the Company had been raised on the faith of the standard price of 3s. 3d., and of the power to increase the dividend by 5s. for every penny of reduction in the price of gas; and yet the Corporation asked for an alteration. If the standard or dividend arrangements were altered, it would be a breach of faith with every person who subscribed to the capital of the Company. It would be not only bad for the Company and ruinous for the subscribers, but a bad thing for gas companies generally, if it were known that the terms on which capital had been found were liable to alteration. He therefore asked the Committee to ignore this part of the petition. The Corporation next took exception to clause 19, by which it is proposed to enact new provisions relating to testing the quality of the gas, and submitted that, if any further powers were conferred on the Company, as proposed by the Bill, additional provisions should be inserted relating to a number of further matters. The first of these was the placing of the Company under obligations limiting the percentage of carburetted water gas and carbonic oxide in the gas in accordance with the report of the Departmental Committee. The amount of water gas at present being used by the Company was, on the average, about 33 per cent.; whereas many companies used about 50 per cent. It would be very serious if, on the occasion of (say) a coal strike, the Company could not add to the illuminating power by means of water gas. So far as Counsel knew, there was no case in which the amount had been limited by Act of Parliament. Another of the suggested additional provisions dealt with the fixing of the standard calorific power of gas to be supplied by the Company, and the making of adequate provision for the testing of gas for calorific power. It was quite true, Counsel remarked, that the heating power had become more important, now that gas was largely used for heating, than formerly, when it was employed exclusively for lighting purposes; but this argument did not apply nearly so much in places like Brighton and Hove as in places where it was used in connection with manufactures. There was no satisfactory calorific test; and he did not know that there was an instance in which testing for calorific power had been provided for, except in the case of the Gaslight and Coke Company last year. The fact that the Brighton Company's gas was to be of 15-candle power was of itself an indication of its calorific power; and it would be hard if the gas had to be tested in respect first of its illuminating and then of its calorific power, and if the Company were to be under penalties in regard to both.

Evidence was then called in support of the Bill.

Mr. *A. M. Paddon*, the Chairman of the Company, examined by Mr. HONORATUS LLOYD, stated that there were very special circumstances which led the Company to wish to create a capital redemption fund. He did not know of anything corresponding to the present case. In 1870, the whole of the manufacture of the Company at Hove was abandoned and taken to a comparatively remote and isolated peninsula at Portslade. This was done largely, he believed, at the instance of the Hove Corporation, who wanted to rid their area of the manufacture. Then, in 1884, the manufacture of gas was discontinued at Black Rock, which was at the other extremity of the area. In each case a considerable portion of the plant was abandoned and thrown out of use. This meant that a lot of capital was left as non-profit earning, and therefore as a burden on the undertaking. Interest on this capital had to be paid, and went to increase the price of gas to the consumer—thus operating detrimentally both to shareholders and to consumers. The Company had tried, by economical administration, to avoid the creation of new capital in connection with the gradual extension of the business, in order to reduce the capital per million. They still, however, dragged the two wounded limbs. In order to get rid of them, the Company sought power to set aside out of revenue a sum per annum until the capital was reduced to £500 per million. This would make the process convenient and not very long. The burden of providing this amount would fall on the consumers and the shareholders in the proportions of the sliding-scale. Broadly speaking, it would be five-sixths against the consumer and one-sixth against the shareholder; but, immediately the process was effected, five-sixths of the benefit would go to the consumer and only one-sixth to the shareholder. This was an equitable arrangement as between the shareholder and the consumer; and it was to the interests of both parties. In one of the Gaslight and Coke Company's Acts, there was a provision somewhat on the lines of the one the Brighton Company were seeking. The Gaslight and Coke Company, however, wrote off their capital out of profits—and thus at the expense of the shareholders alone. This was forced on them as a penalty. In the Brighton case, the proposal was quite voluntary. The Company objected to the No. 1 burner, because it no longer tested the gas supplied by the Company. It destroyed a portion of the illuminating power, which portion the Company had to make good—thus giving the consumer something which Parliament had not given him under the existing Acts. They did not, however, attach great importance to this, because the amount which the burner destroyed, and which the Company had to make good, could not, he thought, be reduced into practical financial value in the price of gas. There was, however, another objection to which the Company did attach importance—namely, that the burner not only misrepresented the gas by destroying a certain amount of its illuminating value, but gave results which varied as the proportions of coal gas and water gas in the gas supplied varied. It was never accurate, and it was impossible to work to. With it, the Company really only guessed at what they did. This was a most disadvantageous state of things for a company carrying on business in face of a hostile Corporation and a hostile test. They therefore asked that they should have the benefit of the No. 2 burner. One proposal of the Bill was to increase the remuneration of the Directors. The business of the Company had practically doubled since the remuneration was last fixed. The Company thought the matter a purely domestic one, which could not affect the Corporation, who took exception to it. The standard price of the Company was very low. The capital had been raised on the basis of the existing standard; and if it were reduced, it would be a breach of faith towards the proprietors of stock. That there should be a limitation in the proportion of water gas was about the most dangerous thing a consumer could propose. In 1900, a very trifling increase in the demand for coal sent up the price of it 60 or 70 per cent., and it was easy to imagine the price to which coal would rise if gas companies were deprived of their present alternative supply of water gas, and were forced into the hands of the coal seller. The supply of carburetted water gas in Great Britain was equivalent to the gas produced from nearly 3,000,000 tons of coal. From every point of view, a calorific standard was unnecessary. It existed only in the case of the Gaslight and Coke Company. In that instance, experiments had been carried on for a time. The circumstances were known, and the Company and the London County Council agreed in thinking that a test might be imposed. Moreover, the Gaslight and Coke Company had a 14-candle standard—the standard which was general throughout the country; whereas the Brighton Company were preserving the 15-candle standard, which, in itself, was an ample safeguard of the quality of the gas. The calorific test question was still much in the experimental stage. He did not think sufficient was known about the subject to advise what was a test. A calorific test was an intricate laboratory matter. It would be very unfair to impose two tests on the Company's gas—one for illuminating and one for calorific power. Although the Brighton Corporation came before the Committee as representing the consumers and ratepayers, they were also engaged in a keen industrial competition with the Company by supplying electric light, and anything which would place the Company at a commercial disadvantage tended to promote the sale of the Corporation's electricity. In addition to the test, the Company already had to face the keenest electrical competition in the United Kingdom. It was not fair for the Corporation first to come to protect the ratepayers and consumers, and then to try to get something which would enable them to bolster-up competition with the Company.

In cross-examination by Mr. TALBOT, witness said he did not think the standard price was ever considered to be the same as the sale price of gas. In establishing a standard a margin was always left. The only cases in which standard prices had been decreased had occurred recently. The reduction was in return for some very big compensation, such as a heavy reduction in illuminating power. There was a strong possibility of a rise in the price of gas throughout the country, on account of the Durham coal trouble. In the case of each of the London Gas Companies, a reduction in standard price had been coincident with a change in their illuminating power from 16 to 14 candle power; but he did not know how far the reduction in standard price in these cases was attributable to the mere fact of the change in illuminating power. Other things affected the matter. If the gas at present being supplied by the Company were burnt through the proposed test burner, it would bring out greater candle power than it showed now; but not 3 candles more. The proposed burner would show more than the present burner, because it would show what the present burner destroyed.

Mr. TALBOT: Do you not see that the effect of altering the burner is to reduce the illuminating power you are bound to supply?

Witness: It is not reducing it below the standard Parliament gave. It is reducing it from an excessive standard—a standard which we have to bolster-up in order to comply with the defects of the old burner. If we get the new burner, we shall no longer have to put into the gas a certain amount of illuminating power that we now put into it.

In other words, you will be entitled by Parliament to supply gas of lower illuminating power than you have to supply now?—At present; but not below the standard given to the consumer by Parliament. The difference to the consumer will not be enough for the Company to offer him anything in the way of price.

Professor *Vivian B. Lewes*, examined by Mr. CLEASE, explained how the argand No. 1 burner came to be used, and how, as carburetted water gas was utilized for enrichment, this burner was found to be over-aerating the gas, and how Mr. Charles Carpenter, therefore, devised the "Metropolitan" No. 2 argand, in which there was the power to regulate the air supply until the best illuminating power of the gas was obtained. He strongly favoured the adoption of the latter burner, because it would bring in something like uniformity throughout the country. At present, owing to testing being accomplished with different kinds of burner, the illuminating power shown meant nothing to anybody. He did not think Parliament would consider the point of limiting the use of carburetted water gas. His view was that there should be not more than 16 per cent. of carbon monoxide in the gas

This percentage was safe for the consumer and fair for the gas companies, because it enabled them to mix in practically half-and-half water gas. Hitherto there had been no legal restriction.

Mr. CLEASE: What have you to say as to the desire for a standard of calorific value?

Witness: I say that there is not the slightest doubt that a standard of calorific value will in future be the standard by which we shall test gas; but the time is not quite ripe for it. The thing is still more or less in the experimental stage. There is only one gas company in the country which has a calorific test; and that was put in by arrangement. There is not the least doubt, when you have it realized how important calorific value is, that the calorific value test will come in place of the illuminating value test. But as a Gas Examiner, and as also knowing a good deal about the manufacturing processes of the country, I should certainly say it would be indefensible to hamper and strangle any industry by putting too many tests on it. If you are working for illuminating value tests and put on calorific value tests, it will be a distinct advance; but do not try to make an already hampered gas manager work to both standards.

Mr. *E. L. Burton*, the Secretary to the Company, also gave evidence in support of the Bill.

Wednesday, March 16.

Mr. *Joseph Cash*, the Engineer and General Manager of the Company, examined by Mr. BALFOUR BROWNE, stated that, notwithstanding the competition of the Corporation electric supply, which was perhaps more severe in Brighton than in any other town, the sale of gas had risen from 897,000,000 cubic feet in 1892 to 1,253,000,000 cubic feet in 1909; the increase being at the rate of 2 per cent. per annum. With regard to the proposal to establish a redemption fund, he was perfectly sure it would be to the advantage of the consumers and shareholders alike to get rid of the £57,000 of obsolete capital. In his opinion, it was imperatively necessary to do so.

Mr. BALFOUR BROWNE at this stage informed the Committee that, since the preceding day, the Parliamentary Agents had drafted a clause saying that the sinking fund was to be limited to £57,000. This would be more satisfactory than imposing the limit of £500 per million cubic feet of gas sold.

Witness, in further examination, said the amount which would be laid aside for this purpose each half year would be about £1700. The period within which the £57,000 would be paid off should not be a very great number of years. When it had been written off, of the benefit that would be derived one-sixth only would go to the shareholders and five-sixths to the consumers. The present capital of the Company, which amounted to £566 per million cubic feet of gas manufactured, was large; and it had been swelled by this sum of £57,000. The restriction to £15,000 of the amount that could be carried forward had worked unsatisfactorily from the time it was imposed, because they were never sure what the condition of the coal market might be. If the Company had been able to have a sufficient carry-forward, they would often have been able to prevent an increase of price; and increases of price were very much resented by consumers. As to the proposed alteration of the sliding-scale, the standard price (3s. 3d.) was very low. If the Company were applying for further capital powers under this Bill, a restriction in regard to dividends such as the Brighton Corporation proposed would probably be made; but he had never known such a restriction to be imposed on a company after parliamentary sanction had been given to the capital powers sought, and after the capital had been issued, on the terms specified, at a large premium. The Company had power to issue a considerable amount of further capital. Gas of 15-candle power could not be economically produced from coal from Durham—the principal source of supply of the Company. Some form of enrichment therefore was necessary; and carburetted water gas practically was the only means of enrichment. Gas so enriched, however, was not fairly tested by the burner at present used. There was no precedent for any limitation of the percentage of water gas. It would be wrong to impose such a limit. If the limit were sufficiently high, it would not be any good; if it was too low, it might prevent the use of water gas in case of necessity. Many things might cause the Company to wish to fall back on water gas. This gas was very valuable in case of emergency; and its use was really in the interest of the consumer. On an average, the Company used 33 per cent. of carburetted water gas; but the percentage, in case of emergency had risen to 41. If a calorific test were substituted for the illuminating test, it might be all right; but to have the two tests of the same gas would be wrong. The two tests did not run together. The gas consumed in Brighton and Hove amounted to over 90 per cent. of the whole; so that obviously the main interest of the Company was in these places. While in Brighton and Hove the number of consumers per mile of main was 201, in the outer areas the number varied from 130 to 34. There was no doubt that a higher charge should be made in the outer areas than in the densely populated inner areas.

Cross-examined by Mr. TALBOT: The standard price ought never to be disturbed. It had been disturbed very seldom. He knew of only three cases—the Gaslight and Coke, South Metropolitan, and the Lea Bridge Companies.

Mr. TALBOT: If the consumer wants gas both for heating and lighting, is it not important that he should know he has a satisfactory gas for both purposes?

Witness: The test imposed at present is one for illuminating purposes; and that we have complied with. The calorific test has been applied in no case except one—the Gaslight and Coke Company; and that is practically by way of experiment.

Witness went on to say that his objection to the calorific test was that while they could control illuminating power—that was to say, if the coal was a little under the mark they could add, by means of hydrocarbons and carburetted water gas, the amount required to bring it up to standard—calorific power was determined a great deal by the quality of the coal which they had to use; and they could not add to that calorific power to maintain a test except by means which were beyond their control. In other words, they were dependent on the quality of the coal which they received. During the last few months, owing to labour difficulties in the North, coal had been of a very indifferent character; and, therefore, no doubt there would have been a diminution in the calorific power from a cause for which they were in no way responsible.

Mr. TALBOT: Is it not to the interest of the consumer that he should know that his gas is of a proper quality for heating, as much as for lighting?

Witness: I should think there is very little variation in the calorific power of gas from time to time.

Then I do not understand what you mean, because in that case there would be no difficulty in keeping a proper standard?—If we had coal of bad quality, down would go the calorific power from a cause that we could not prevent.

Then you tell me there is very little variation?—It is only because we have had trouble, as we have had lately, when the coal varies; and that is from a cause beyond our control.

Have you ever tried to test it?—I have made tests; but only so short a time ago as when your petition, in which you alleged it, was put in. The apparatus is not yet in fair working order; so that I cannot answer any question as to variation.

I may take it that until this Bill you never did test calorific power for your own satisfaction?—No.

In further cross-examination, witness said he tested for carbon monoxide twice daily. He aimed at making the percentage 12. If it went up to 13, orders were given to bring it back to 12. The highest he had ever known was 16. It did not matter to the consumers whether the percentage was high. So long as the gas was not misused, there was no danger in a high percentage.

Mr. VESEY KNOX cross-examined witness at considerable length with regard to the circumstances and conditions in the outer and inner districts of the Company in support of the claim of the outer areas for a lower price of gas.

Mr. *H. E. Jones*, examined by Mr. HONORATUS LLOYD, said that, having regard to the special circumstances of the Company, it was desirable that there should be a capital redemption fund. The capital of the Company was above what it ought to be, having regard to all the circumstances of the case. It was in the interest both of the consumers and of the shareholders that the dead-capital should be got rid of. He approved of the proposed change of burner for testing purposes. The change would cause a saving in the cost of production; but the saving would be extremely minute. There would be a difference of $\frac{3}{8}$ candle when testing 15-candle power gas. This $\frac{3}{8}$ candle represented a little over $\frac{1}{4}$d. per 1000 cubic feet of gas. If there was a saving, four-fifths of it must, under the sliding-scale, go to the consumer. The change of burner was felt to be so serious that the Institution of Gas Engineers had approached the Board of Trade in regard to it; and the Gas Companies' Protection Association had also approached the Board of Trade to have it taken up as a public question, owing to the great disadvantage which at present existed of not comparing like things by like standards. The Company should be allowed to use water gas as they had done in the past. A limitation of the proportion of carburetted water gas might have a very large effect on the price. He was somewhat anxious owing to the eight-hour movement in the coal trade. There had been a tendency for coal to rise. Some gas companies had to pay, through hasty contracts made in the middle of last winter, very large prices for coal; and those companies which had no water-gas plant had to supply the whole of their extra requirements from this dear coal. It so happened, however, that at that time American oil was reduced in price. As an economic factor in the administration of gas supply, it was valuable to have something to countervail the coal-owner, who otherwise would have them quite at his mercy. But for the large amount of water gas which was made throughout the kingdom, he was satisfied the price of gas coal and the price of gas would rise considerably.

In cross-examination by Mr. RAM, witness said there was no precise precedent for putting on the consumer the necessity of finding any portion of the money which was to wipe off old capital. Compulsion was put on the Company to move their works from Hove, and also the smaller works of the old Brighton Gas Company from the Black Rock end of Brighton. The change was in the interest of both parties. The Company benefited by getting free access to the sea at Portslade, and the Local Authority by the removal of the works. Witness admitted that, in a sense, if the money was not expended in wiping off the old capital, it would be available for a reduction of the price of gas.

In cross-examination by Mr. TALBOT, witness said that in 1904, before Lord Rayleigh's Committee, he expressed the opinion that the proportion of water gas should not be more than one-third. It was an awkward thing for a witness to say he had changed his opinion. He would rather say he had modified his opinion about water gas. His experience was that it had not been found so injurious as it had threatened to be.

Mr. *E. Herbert Stevenson*, examined by Mr. HONORATUS LLOYD, gave evidence in support of the Bill. The capital redemption fund, having regard to the circumstances of the Company, was fair. It was to redeem dead-capital of the past, just as the special purposes fund could be used to redeem the dead-capital of to-day or in the future. It was not in the interest of either shareholder or consumer to carry forward the burden of dead-capital for all time, and to pay interest on it. It should be wiped out as a municipality wiped out its capital from ordinary revenue. He did not think any alteration in the standard price should be made if the test burner were altered. In 1893, an extra candle was put on the Company, in accordance with the practice of Parliament then, which was to put 15 candles on everyone without giving anything at the same time. When the cost of production was thus raised, the opponents did not suggest that there should be a corresponding increase in standard. It would be eminently unfair, as the Company obtained nothing then, to take off something now, when, by the alteration of burner, they were merely asking Parliament practically to place them in the position in which they were in 1893. The saving in cost to the Company, owing to the change of burner, would be about three-eighths of a penny, not more, per candle. The change would involve about one candle, perhaps a shade more, which, in money, meant less than $\frac{1}{4}$d.—a rather difficult sum to deal with in connection with standard price. Of this $\frac{1}{4}$d., four-fifths would go to the consumer. There should

be no limitation of the proportion of carburetted water gas. He was of opinion that a test for calorific power would come some day; but it would come, he hoped and trusted, generally. He did not think it would be fair to put two tests, with two penalties, on a company with regard to its gas. He hoped that, until the illuminating power test was done away with, the calorific test would not be put on the general run of companies.

In cross-examination by Mr. RAM, witness said he did not think the standard price should be altered unless a company received a large benefit. He objected to a calorific test, because it was practically a second test for the same thing. It was as important that the consumer should know that he was getting the right amount of heat as the right amount of light. But, generally speaking, with the present methods of gas manufacture, when they knew the composition of the gas and its illuminating power, they could tell very nearly what the calorific result was. Two tests were, practically, unnecessary. The calorific test would be better than the illuminating test.

Mr. RAM: Do you desire to have a calorific test?

Witness: Yes; and abolish the illuminating test, because so little gas is used for purely illuminating purposes.

Mr. BALFOUR BROWNE: Will that satisfy you?

Mr. RAM: I want to see how far Mr. Stevenson will go with me.

Witness: If you will strike out the illuminating power test, we will take a fair calorific test. Only there is this about it—up to the present we do not know what is a fair calorific test for this Company.

In cross-examination by Mr. VESEY KNOX, witness said he did not know of any other case in the United Kingdom in which there was a differential rate against the district where the manufacturing gas-works were situated.

Cross-examined by Mr. HUTCHINSON: He did not agree that, if the new test burner were adopted, the consumer who used a flat-flame burner would be in a worse position to the extent of 8d. per 1000 cubic feet, that the person who used a cooking-stove would pay 3d. per 1000 feet more, or that the man who used an incandescent burner would pay 2d. per 1000 feet more.

Re-examined by Mr. BALFOUR BROWNE: The gas, before being distributed, was carried from the works into Hove and back again.

This concluded the case for the Bill; and evidence was at once called in support of the petition of the Portslade, Southwick, and New Shoreham Urban District Councils.

Mr. *William Newbigging*, examined by Mr. TYLDESLEY JONES, stated that the Brighton Company, in the year 1908, spent on repairs, maintenance, and renewals 10·74d. per 1000 cubic feet; whereas the corresponding figure for all the companies and for all the provincial corporation gas supplies was 7·24d. From this he drew the inference that the Brighton Company were somewhat extravagant in their expenditure on repairs and maintenance, or, in other words, that they were really charging to revenue items which ought to be charged to capital. The standard price in the inner area was 3s. 3d., and in the outer area 4s. 2d.—a difference of 11d. It was proposed by the Bill to reduce the price in the outer area so that it would not exceed the price in the inner area by more than 6d.—the actual difference at present. Thus the consumer would be no better off after the Bill was passed than he was now. There were many other places in the South of England where the price of gas was lower than in Brighton. The differential charge of 6d. was excessive. It was not necessary to take the gas from the works to the holders at Hove and back again to the district. A holder could be erected at the manufacturing works at Portslade and gas distributed thence. If the Company chose to distribute from the Hove holders, that was no reason why the outer area should be penalized in the matter of price as they were at present. The extra cost of mains in the outer district was 1d. per 1000 cubic feet. Beyond this penny, he could see no additional cost in supplying in the outer areas; and he could see therefore no justification for charging 6d. more for gas supplied there. The effect of the Company using the "Metropolitan" No. 2 burner would be that they would be able to send out a poorer quality of gas than they had been doing, and would still satisfy the 15-candle condition. If the gas now being supplied, which, when tested in the No. 1 burner, showed an illuminating power of 15 candles, were tested in the No. 2 burner, it would probably give an illuminating power of about 17 candles. He had made tests to ascertain the calorific value of the lower quality gas. These showed that for every reduction of one candle the calorific value was reduced 3 per cent. This was of great importance to consumers, especially those who used gas for cooking and heating purposes and in incandescent burners. The substitution of one burner for the other, and the consequent supply of a lower-grade gas, represented a saving to the Company in the cost of manufacture which he put at about 1d. per candle. Assuming the penny were given to the consumer in the shape of reduction of price, the position of the consumer would be distinctly worse. He was very strongly of opinion that it was not a wise thing for any gas undertaking to send out gas of the quality that the Brighton Company could send out if the powers now sought were granted to them. It was a very praiseworthy object to endeavour to reduce capital; but it should be done at the shareholders' expense, not at the consumers'. The effect of the capital redemption clause would be to place on the consumer in the immediate future the burden of paying, for the benefit of posterity, for the excess of capital over £500 per million cubic feet. The burden would be equivalent to just under 1d. per 1000 cubic feet. The consumer would have to find the whole of the £56,000 in order to get his penny reduction in the price of gas. This would be of advantage to the shareholder, who, for the benefit of having his undertaking released from this debt, would simply go without the ¼ per cent. dividend.

Thursday, March 17.

On the resumption of the proceedings to-day,

Mr. *William Newbigging* was cross-examined by Mr. BALFOUR BROWNE. He said the average expenditure of the London suburban gas companies on repairs, maintenance, and renewals should not be taken as an example for Brighton. These companies were spending a great deal more than they should do. The average of the provincial companies—namely, 5·68d.—was about the right figure. He did not allege that the suburban companies were badly managed; but they were spending much more on repairs than they need. It was true that the figure of the Mitcham Company was 16·49d., as against Brighton's 10·74d.; but Mitcham must be grossly extravagant—there must be some special reason to explain so high a figure. With reference to the argand No. 2 burner, which he thought would mean increased gas consumption without better illumination, it might be perfectly true that, since the burner had been introduced into London, the consumption had not gone up; but bad trade and the increasing competition of electric light might account for this. He approved of the principle of writing-off dead-capital, but not at the expense of the customers.

Mr. BALFOUR BROWNE: You are laying away at Macclesfield a sinking fund to pay off the whole value of the works at a certain date. Who is paying that—the consumers, I take it?

Witness: Yes.

That is, the consumers of gas to-day for the benefit of the gas consumers at some distant future date?—Yes; but this is the difference. The gas consumers in Macclesfield are owners of the undertaking. They are in the position of the shareholders of the Brighton Company; and, as owners of the undertaking, they are paying off their capital.

But is not that an absolute fallacy? Don't you see that if I, being a consumer in Macclesfield, leave the town I cease to be an owner of the works; yet I have been contributing all along to the sinking fund?—Yes; but you cannot take a single consumer in that way.

For forty years the people go on paying off capital for the benefit of the people after forty years hence?—Well; the people of past years have done the same thing for us.

Dealing with the calorific power test, witness said that for every candle reduction in the illuminating power they lost 3 per cent. on the calorific test. He was aware of the elaborate tests that have been made by London Companies for years for calorific power. Asked if the results showed a variation of from ¾ to 1½ per cent. instead of 3 per cent., witness said he found 3 per cent. in his own town. It depended on the constituents of the coal. With regard to differential rates, he admitted twenty cases put to him by Mr. Balfour Browne in which Parliament had granted such differentiation.

Re-examined: None of the twenty cases were those of differential rates in thickly-populated outside districts. He did not know any single case which had come before Parliament in recent years where there was a differential rate as against an urban population of 18,000 people.

Mr. *J. E. Bell*, solicitor, of Brighton, gave evidence on behalf of the outer districts in opposition to a differential rate, which, he contended, was unjustifiable in view of the increase in the population, rateable value, and number of consumers.

Mr. TALBOT, addressing the Committee on behalf of the Brighton Corporation, said the first thing they asked for was a reduction in the standard price from 3s. 3d. to 3s. The objection made, that they had no right to reduce the standard price, came too late. It had been done repeatedly. The Bill of the Lea Bridge Company formed a precedent; and since then the same thing had been done in the case of the three great London Companies. Their claim on this was that if the candle power was in fact reduced by the Bill, the consumer was entitled to a reduction in the standard price. As to the capital redemption fund, there was no precedent for this clause. The Company, of course, had a perfect right to redeem their capital; but it should be done by the shareholders and not by the consumers. There was only one case in which a clause of this kind had been authorized by Parliament, and in that case (the Gaslight and Coke Company, 1903) the capital redeemed was taken from the dividend, after it had had its effect under the sliding-scale in reducing the price—in other words, the fund was made up by the shareholders, not by the shareholders and consumers. This was a wholly reasonable basis. But it was a strong order that the consumers for the next six or twelve years should be penalized in this way without their consent. They had considered the question of the calorific test very carefully. They did not desire to press this point, because it was now admitted—what they had always contended for, but what certainly used to be denied—that the calorific value of gas did, in fact, vary roughly with the illuminating value. If they were successful in maintaining the present illuminating power, or in giving to the consumers the equivalent in the reduction of the standard price, they did not think they ought to press for a double test, the result of which would not, in their opinion, be financially worth all the expense and trouble. Then there was the question of carburetted water gas. There was no doubt that this gas was more poisonous than coal gas. The Home Office Committee of 1899, in their report, recommended that a limit should be fixed which the proportion of carbon monoxide in gas should not exceed. As the Government had not found time to legislate on this subject, what he desired was, not that the Committee should fix a limit, but that, if the Home Office thought fit to make regulations as to the quantity of carburetted water gas, the Company should be bound to conform to those regulations.

Mr. *Stevens*, the Borough Accountant of Brighton, said the annual amount which might be appropriated by the Company for the capital redemption fund was £3554. If this sum were applied in the purchase of ordinary stock for cancellation, the process of redemption would probably last for thirty years. Of this £3554, the portion which would be borne by the consumer was approximately £2900, and £654 would be paid by the shareholders. For every £3554 thus taken out of revenue and applied in the cancellation of stock, the annual saving in the amount of dividends would only be about £170; so that before the annual saving in dividends closed, something like 19 years would have elapsed. During that time the effect of the operation would be to tend to postpone the possibility of a reduction in price. It would be a hardship on consumers for the next 19 years to require them to provide this sum for redemption purposes.

Mr. *Isaac Carr* said he had made tests of the Brighton gas both with the old burner and the one which it was proposed to use, and he found a difference between them of 4 candles. The lowering of the illuminating power would reduce the cost of production to the extent of ½d. per candle per 1000 cubic feet. This would give them a saving of 2d. in respect of the four candles. Whether in lighting or heating, the consumer would have to use a larger quantity of gas to procure the same effect, no matter what type of burner was used. He estimated that the consumer of gas by the flat-flame burner would be penalized

by this proposed alteration to the extent of about 25 per cent., which was based on the difference he found by his tests of the Brighton gas. This would amount to about 8d. per 1000 cubic feet. The consumer would have to burn 1250 feet of gas in place of 1000 feet. He had been unable to make a test for calorific value, so he had had to base his figures on the loss in calorific value from the results obtained in his own works. He found that a fair average to take in the falling off in calorific value for every candle was 3 per cent.; and, on the basis of a 4-candle fall, it would make 12 per cent. falling off in calorific value. This would amount to about 4d. per 1000 cubic feet. Asked to what extent the user of the incandescent burner would be damnified, he said he had based his figures upon the results obtained elsewhere (not in Brighton), both with coal gas and mixtures of carburetted water gas with coal gas; and he found that the falling off would be about 2 per cent. per candle, or about 8 per cent. as of total. To sum up the situation, it would be correct to say that the proposed change would give the Company the benefit of 2d. per 1000 cubic feet in the manufacture, and the consumers of gas would be affected to the extent of from 8d. down to 2d. With regard to the redemption fund, he did not see any reason of policy or otherwise why the consumers should be called upon to pay for the redemption of the old capital, and it would be unfair to put that additional tax upon them.

Dr. *J. S. Haldane* was the next witness. He said he was nominated by the Home Secretary in 1898 to serve on a Committee to inquire into and report upon the extent to which water gas and other gases containing a large portion of carbonic oxide was manufactured and used for various purposes, and the dangers attending such manufacture and use, and the means whereby they might be diminished. The report of the Committee was a unanimous one. Witness put in a table showing the statistics of death from gas poisoning in this country and America, which said:

> From the table it is evident that by no possibility can the conclusion be avoided that the distribution of carburetted water gas without any special precautions, is enormously more dangerous, or, to speak more correctly, less safe, than the distribution of coal gas. Roughly speaking, the loss of life arising in one way or another—accident, suicide, or homicide—appears to be fully a hundred times greater with water gas in America than with coal gas in this country. While coal gas is an exceedingly safe, as well as cheap, good, and convenient illuminant, water gas as distributed in America is very far from being safe. Assuming that Boston has a death-rate equal to that of London, about one in every 300 deaths is due to accidental water-gas poisoning. This represents an annual death-rate about the same as that of "child-birth" or of "suicide" as returned in the official statistics for England and Wales for 1880 to 1890. The total death-rate for poisoning of every kind in this country, whether accidental or suicide, and whether by solids, liquids, or gases, is only about half the average death-rate from water-gas poisoning alone in Boston, New York, San Francisco, and Washington.

That Committee took *viva voce* evidence from America. He agreed to a further quotation from the blue book which stated: "It is clear that with coal gas of ordinary composition it is almost impossible to produce a poisonous atmosphere in a room by simply leaving the gas turned on during the night; whereas with water gas a poisonous atmosphere is easily produced even in very large rooms."

Mr. TALBOT: Will you give your opinion on the matters discussed here? The first is whether the danger arising from the unrestricted use of carburetted water gas is a serious matter, and the second is whether it is necessary, in your opinion, that some restriction should be put upon it. I may take it first that you agree with the report of the Committee which you signed?

Witness: Yes, I do.

Has there been anything that has happened since that which has altered your opinion?—I think there is one circumstance which would probably diminish the danger somewhat, and that is the fact that at present incandescent burners have largely taken the place of flat-flame burners, and that an incandescent burner as a rule burns less gas. Consequently, the danger from leaving the gas turned on at night is rather less. I think that these American deaths were due to people simply going to sleep with the gas turned on from a flat-flame burner. It is difficult to say how many were suicidal and how many were accidental. The danger would be appreciably less at present, because the amount of gas that would escape would be less.

The Committee, of course, reported that, in their opinion, it was essential, in the interests of public safety, that some restrictions should be introduced on the manufacture of carburetted water gas?—Yes; it was thought desirable. But no restrictions have been introduced; and I do not think the occasion for it has occurred, because, so far as I know, no English company has distributed undiluted water gas, and the proportion has been kept down to something quite reasonable.

We have had evidence before this Committee that, in fact, carburetted water gas is being manufactured to-day in Brighton to the same extent as it was at the date of your report; therefore no increase has occurred in fact. But I may ask you whether, in your opinion, a considerable increase in the supply of carburetted water gas ought to be restrained?—Yes; I think any very large increase on what has been distributed hitherto ought to be restrained. It is restrained voluntarily by the gas companies at present; but one would like to see it made perhaps a little more certain.

Replying further to Mr. TALBOT, witness said he thought it was a reasonable way of dealing with the matter in this case that if the Home Office should issue any regulations restricting the supply of water gas to any amount, the Company should be bound by them. The Committee to which he had referred mentioned a maximum of 20 per cent. of carbon monoxide. The way in which the Committee expressed themselves in 1899 was: "Limit the proportion of carbonic oxide in the public gas supplied at night to 12 per cent., or to such greater amount as the department may consider desirable."

Mr. BALFOUR BROWNE: You have said that in that report you have recommended that restrictions should be introduced. The report dealt specially with, and your evidence dealt specially with, carburetted water gas in America?

Witness: Yes.

I saw in one of the figures you gave that they were supplying 93 per cent.?—Yes; and 100 per cent., too.

Has that any bearing upon an English company who keep down the percentage to 30?—I think very little.

You said the occasion for restrictions had not occurred?—No; because the gas companies have been very sensible on the subject.

With regard to carbon monoxide, supposing you find a company who keep it down to 12 per cent. and complain whenever it goes up to 13 per cent., would you think that company were doing their duty? Supposing a company test twice a day for carbon monoxide and keep it down to 12 per cent.?—I should say that company was certainly doing its duty fully.

And you might go up to 16 or 17 per cent. without serious fault?—Yes; I think so.

Is there any reason why the people of Brighton should be put under restrictions any more than any other body in the country, and that the restrictions should not be general?—That was the recommendation of the Committee.

And if it is dangerous in Brighton not to have restrictions, it must be dangerous elsewhere?—Yes, certainly.

You know that there are a very large number of companies in the country who enrich their gas with carburetted water gas?—Yes.

And there is no restriction on one of them?—No; but one or two of them have been very rash.

You are one of the people who put upon London the No. 2 burner, or you assisted in doing it?—We are very limited as regards our choice of burners, and so on, by the Acts which control the matter; and we are not responsible for the Acts.

For testing gas with carburetted water gas in, the No. 2 burner is a good one?—Yes.

Have you made any tests to see what difference would be returned in 15-candle gas with the argand No. 1 and the "Metropolitan" No. 2?—We made very careful tests on this point some years ago.

Would it be absurd to say that it made a difference of 3 or 4 candles?—I think that would depend to a certain extent on the kind of gas tested. There would be a substantial difference in them all.

Am I right in saying that the argand No. 1 does destroy the illuminating power of gas with water gas in it?—You get better results from the gas by the other burner, I will put it in that way.

That is exactly the same thing, is it not?—I am afraid from the point of view of the public it is different.

Even from the point of view of the public, is not the idea of a burner to test gas to get a burner that will do justice to it?—I should say the public rather want to have some measure of the value of the gas as they use it. They may use it with a flat-flame burner, in fact.

I understood that the idea, when this was adopted, was to get a burner to be used by the public?—The public would not use the No. 2 burner.

You would not have gas tested with a flat-flame burner and an incandescent burner, would you?—I think the flat-flame test is the fairest.

Why did not the Referees prescribe that?—They could not, because they are entirely bound down by Parliament on the subject.

The burner that is prescribed is the No. 2 "Metropolitan"?—That is so. The public can if they like stand by their burner and screw it up or down so as to get the maximum amount of light from it; but they would not do that.

Then, apparently, Parliament puts on you the necessity of choosing the "Metropolitan" No. 2 burner?—Practically speaking.

And for the gas in London it is an excellent test-burner?—Everybody knows what the tests mean.

Re-examined by Mr. TALBOT, witness said that in the report it was stated: "If, then, the danger from water gas is considerable, it is important that in this country it should be dealt with before the causes of it reach unmanageable proportions." In America, in some places the companies scrapped entirely their coal-gas plant and manufactured only water gas. When that had happened, it was very difficult to restrain the use of carburetted water gas, because it would inflict very serious financial loss on the companies. When the report was issued, their view was that if restrictions were to be imposed it should be when the use of carburetted water gas was still comparatively moderate. He did not see any prospect now of anything like pure water gas being used in England. He did not think any company would do it in face of the report.

Mr. TALBOT: It is not that you object to the restriction; but you think the restriction ought to be put on by the voluntary action of the companies rather than by definite legislation?

Witness: I should not like to express any opinion upon that point so long as the amount of carbon monoxide is restricted.

So that if a restriction is to be put on at all, it must be at this stage and not at the American stage?—At the time the report was written, it appeared as if carburetted water gas might be distributed undiluted in this country; but at the present time I do not think there is much prospect of that.

The CHAIRMAN: You think the case for restriction by a Public Act is not now so necessary as it was at the time you made the report?—I do not think it is so necessary as it appeared to be then, for the reason that the companies have, on the whole, been very careful.

Mr. HENRY: If a restriction was not inserted in the Bill, what percentage would you suggest it should be generally?

Witness: I should suggest the maximum figure stated by this Committee, of 20 per cent. of carbon monoxide; and I should expect the restriction to work out in this way—that it would very seldom indeed happen that the percentage would go up to 20 per cent.

How much carburetted water gas would that restrict the company to?—It, I think, would work out to about 50 per cent.

Mr. *Isaac Carr* was recalled and cross-examined by Mr. BALFOUR BROWNE. He said that where it was a case of changing the burner and not the illuminating power, he did not know of an instance where the price had been reduced, excepting by agreement. Asked if he could give a case where this burner had been adopted and where there had been anything like the increase of 25 per cent. in the consumption of gas which he had stated, witness said his opinion was that there had been no marked increase for the reason that the introduction of the burner had been concurrent with the introduction of incandescent lighting; and while the consumer had had to use more gas to get his light by the incandescent burner, he had actually used less than he

did with the old flat-flame burner. So that while the poor gas and the incandescent burner had required more, it had not required as much as it had with the flat-flame burner.

Replying to Mr. TALBOT, witness said that if the use of the gas was the same, the quantity must be increased by 25 per cent. On the 10th inst., he tested the Brighton gas with the two burners; and the difference between them was 4 candles. Whether coal gas or carburetted water gas was used, he found practically the same difference, or the same relation of difference. It varied a little according to the composition of gases.

Mr. *J. G. Newbigging* said he had made a test of the Brighton gas and got the results which had been stated. Further than this, in order to guide his Committee in Manchester, since this burner was introduced he had carried out investigations to see what the effect of the test burner would be on the consumers. In consequence, his Committee had decided that it would be injurious to the consumer if, when using this burner, the illuminating powers were reduced below 17 candles. As a fact, they actually distributed gas showing about 18 candles with the No. 2 "Metropolitan" burner. Therefore the actual reduction in the case of the Brighton gas would be 4 candles; and this effect was not only confined to the illuminating power of the gas. The calorific value would go down about 3 per cent. per candle. In incandescent lighting, they did not get the full effect of the reduction in calorific value. The flame temperature entered into play; but from numerous experiments he had made of the gas, he found a loss of efficiency of about 8 per cent., which would be equivalent, on the present price of gas in Brighton, to 2·8d. Taking it all round, and the injury to the gas consumers generally, at least 3d. should be given in reduction of the standard price.

Friday, March 18.

On the hearing being resumed this morning,

Mr. RAM addressed the Committee on behalf of the Corporation of Hove. He said their case was very similar to that of the Brighton Corporation. He proposed to call no evidence other than that called by Brighton; but he would reserve himself for cross-examination, and that at a very moderate length. They were asking that the cost of gas in Hove should be lowered, and that there should be an alteration of the standard price. There was very often a common interest between the consumers and shareholders of the Company; but in this regard they did not wish to cripple the Company in any way at all. What the Hove Corporation wanted was not that the Company should be crippled, but that any advantage obtained by the Company should be fairly and proportionately shared between the shareholders and the consumers. It had been the practice of Parliament for years to see that this was done. According to the evidence of Mr. Stevenson, there was a saving to the Company of 1d.; and he agreed that they should get the benefit. Counsel contended that the benefit was to the extent of 2, 3, or perhaps 4 candles; and certain of the witnesses had not denied that there was damage to the consumer. The burner was not the only advantage they sought, which would enable them to supply gas at much less cost to themselves. With regard to the redemption of capital, they desired to assist the Company in every way; but the fund would put the shareholders in a much better position—it would enable them to borrow money much more easily, and put into their pockets a larger amount. What he asked was that the money should not come out of the pockets of the consumer. The capital redemption fund should be granted; but it should be put on the same basis as the special reserve fund—namely, out of the accretions of the shareholders' money. On the question of water gas, there had been no general legislation on the recommendations of the Parliamentary Committee. There was the expert evidence before the Committee that the danger to-day, if gas were to escape, was as great as ever; and it was admitted by everybody that if there were a coal crisis it might be to the advantage of the Company, in that they would almost be driven to use a very much larger amount of this poisonous compound. What he asked the Committee to say was that, in the event of the Home Office finding it necessary to make regulations with regard to the use of this gas, the Brighton Company should come under the regulations.

The CHAIRMAN at this juncture held a short conference with the members of the Committee, and remarked that they were in agreement on certain points. They would like Clause 10 to be brought as nearly as possible to the Model Clause. With regard to Clause 11—on the question of capital redemption—they were prepared to allow it so long as the amount (£57,000, or whatever it might be) was specified.

Mr. BALFOUR BROWNE indicated that these points should certainly be attended to.

The CHAIRMAN said the Committee would like something to be put in to show that it was in the nature of a special case, and not in the nature of a precedent.

Mr. BALFOUR BROWNE remarked that they were compelled to remove the works from one place to another; and in this way this was a special case, and should not be regarded as a precedent. They would bring up a clause which would satisfy both the Committee and the opposition on the point.

The CHAIRMAN said the Committee were prepared to allow Clause 12, with regard to the application of excess of profits over authorized rates of dividend, so long as it was a model clause. With regard to the question of water gas, the Committee felt that if this was dealt with at all, it ought to be by public legislation, which would affect all companies equally; and they were not prepared to put anything in the Bill with regard to this.

Mr. BALFOUR BROWNE then briefly referred to the points outstanding, which were: (1) That the outside authority should have the gas supplied in their district at the same rate as in Brighton; and (2) the demand on the part of Brighton and Hove to have the standard price for gas reduced from 3s. 3d. to 3s.

The CHAIRMAN: The question with regard to the reduction of price rests upon the burner?

Mr. BALFOUR BROWNE said if they were not going to have the "Metropolitan" No. 2 burner, all the argument would go. The principle was that the outlying districts should pay more. It was admitted that the cost of mains would be more in an outside district; and the Company were only asking that a maximum price should be fixed beyond which they should not go. It was not by keeping up prices that a gas company succeeded, especially when it was competing in Brighton with the Corporation, and in the district of Hove with a Company; and there was also the point that in these outside areas there would be electricity. The opponents to the Bill contended that there was a difference of 3 candles between the burner they had been using and the one it was proposed to use. If this was true, and a candle meant ½d. as the opponents said and ⅝d. as the promoters said, on 3 candles did the difference amount to 3d.? There was no evidence to warrant the reduction of the standard price from 3s. 3d. to 3s. The Company were not at all reducing the quality of the gas. They were bound to give 15-candle power gas; but they were asking that it should be tested by an efficient burner instead of an inefficient one—and this was the burner which was prescribed by the Board of Trade. The special purposes fund was to provide for insurance and renewal, which was of no advantage to them, and the other advantages would not count in money.

The decision of the Committee on the three remaining points was that the Company should have power to use the "Metropolitan" argand No. 2 burner; the standard price should be reduced from 3s. 3d. to 3s. 2d.; and in the outlying districts, instead of the differential price being 6d. per 1000 cubic feet, it should be 3d.

Mr. CHARTERIS, on behalf of the East Sussex County Council, brought forward a clause asking that the Company should be responsible for the extra cost to which the County Council might be put by reason of the improvement in the way of deviation or alteration of level of the pipes in the roads.

Mr. BALFOUR BROWNE contended that if the County Council were doing this for the benefit of the public, the public should pay.

The Committee decided that the cost should not be borne by the Company.

BISHOP'S STORTFORD, HARLOW, AND EPPING GAS AND ELECTRICITY BILL.

House of Lords Committee.—Tuesday, March 15.

(*Before Lord* HYLTON, *Chairman, Lord* LILFORD, *Lord* SEATON, *Lord* CATHCART, *and Lord* TEMPLEMAN).

This is a Bill for amalgamating the Bishop's Stortford and District Gas Company, the Harlow and Sawbridgeworth Gas Company, and the Epping Gas Company, and for vesting in the amalgamated Company the undertakings of the Ongar Gas Company, Limited, the Newport (Essex) Gas Company, Limited, and the Much Hadham Gas Company; to purchase by agreement the undertaking of the Dunmow Gas Company, Limited; to empower the amalgamated Company to supply electricity; and for other purposes.

Mr. HONORATUS LLOYD, K.C., Mr. CLODE, and Mr. A. M. PADDON appeared for the promoters; and the Bishop's Stortford Urban District Council were represented by Mr. BARNARD LAILEY.

Mr. HONORATUS LLOYD, in opening the case for the promoters, explained that the Bishop's Stortford and District Gas Company, the Harlow and Sawbridgeworth Gas Company, and the Epping Gas Company had statutory powers adjoining each other. The Ongar Gas Company had no statutory limits, inasmuch as they had no statutory powers; but they were asking that the limits of the Company should be defined. The object of the Bill was to amalgamate the three first-named Companies into one, and to vest in the amalgamated Company the undertaking of the Ongar Company, bringing the whole district under statutory powers. There were two other Companies—the Newport (Essex) Gas Company, Limited, and the Much Hadham Gas Company—which were non-statutory concerns; and arrangements had been made to take these over and vest their undertaking in the amalgamated Company. The areas supplied by these two Companies were within the statutory area of the Bishop's Stortford Company. There was also a proposal to extend the limits so as to include a small portion on the east of Bishop's Stortford. The district which it was proposed to put into the amalgamated area was governed locally by some eight or nine different local authorities; but only one of them raised any objection to some of the proposals in the Bill. They desired to combine the whole of these six undertakings into one. The shareholders were all in accord with the proposal. As time went on, some of the existing works would be linked up, and it would not be necessary to carry on the manufacture of gas at all the works. The gas would be stored at different points. It might be desirable, however, to dispense with first one set of works and then another; and so secure more economical and convenient working. The Bishop's Stortford Company had at present a total authorized share capital of £65,000. Of this, £35,391 17s. 6d. had been issued; leaving £29,608 2s. 6d. unissued. The issued capital was so divided up that there was £22,000 of original stock, which bore a standard dividend of 7 per cent.; there was additional capital issued to the extent of £5620, also with 7 per cent. standard dividend; there was £4000 of 5 per cent. preference and £3000 of 4 per cent. preference stock all issued; and there had been realized upon the sale of stock by auction, premiums amounting to £771 17s. 6d. In the amalgamated Company, it was desirable, if possible, to have only one class of stock. The £22,000 which had been issued of 7 per cent. stock in the Bishop's Stortford Company was converted into 5 per cent. standard stock in the new Company. They merely altered the nominal value of the £22,000 of 7 per cent. stock into £30,800 of 5 per cent. stock. With regard to the additional capital, there was £5620 of 7 per cent. issued; and this was turned into 5 per cent. stock in the same way. Then there was left of the existing Bishop's Stortford Company's capital £4000 of 5 per cent. preference stock, which became £4000 of 5 per cent. in the new Company. There was also issued £3000 of 4 per cent. stock, which became £3000 of 4 per cent. stock in the new Company. With regard to the Harlow Company, the original capital issued was £21,000; and there was £12,000 additional 5 per cent. capital authorized, but none of this was

issued. Therefore the total issued in the Company was £21,000 of 5 per cent. capital, which was turned into £21,000 in the new Company. The Epping Company had original £10 shares bearing 5 per cent. interest, £21,000 issued, and £10 shares additional 5 per cent., £3500 issued, with a premium raised under the auction clauses of £698 9s. 9d., or a total of issued capital of £24,198 9s. 9d. There was unissued £15,801 10s. 3d., and that issued amounted, without premiums, to £33,500. This capital was turned into the same—£33,500 of 5 per cent.—in the new Company. The Ongar Company, which was a non-statutory concern, paid whatever they could make, and had been paying a 10 per cent. dividend. The total share capital of the Company was £6000; and this involved doubling the nominal capital to put it on the same basis. The Newport Company had £2400 issued; and they were given £2400 of 5 per cent. Therefore there would be a total original capital in the new Company of £104,568. The unexhausted capital powers of the Bishop's Stortford, Harlow, and Epping Companies amounted to £57,409 12s. 9d. They were asking by the Bill a further sum of additional capital of £135,432, and for £80,000 borrowing powers. There was provision in the Bill for what were called inner and outer areas, and for a differential price for gas according as the consumer was in the inner or outer area. Generally, the provision was that whereas the standard price in the inner area was fixed at 4s., it was sought to be able to charge not more than 1s. extra per 1000 cubic feet in the outer areas. If the amalgamation took place, it would be a little inconvenient to have three different sliding-scales; and therefore it was proposed to have a 4s. standard over the whole area, instead of 4s. in Bishop's Stortford, 3s. 11d. in Harlow, and 4s. 3d. in Epping. The Local Government report said: "The proposed limits of supply are very extensive; and it appears to the Board to be a matter for consideration whether it is for the interest of the parishes concerned that the powers as to the supply of gas within such a large area should be centred in one Company, especially having regard to the increasing tendency of local authorities to undertake the lighting of their districts." Counsel pointed out that there was not one of the eight or nine local authorities who desired to undertake its own lighting.

Mr. *E. L. Burton*, the Chairman of the Bishop's Stortford Company, in giving evidence, said he was confident that if the proposals in the Bill were approved they would result in a benefit to the consumers in the districts. There was no proposal to alter any of the enactments as regards standard price, dividends, illuminating power, &c., with the exception that with the Epping Company there would be a reduction in the standard price from 4s. 3d. to 4s.; in Harlow, from 3s. 11d. to 4s.; and with regard to Ongar, where there was no limitation, the price would be fixed at 4s. There was also the difference that in Sawbridgeworth the consumers might have to pay £2 10s. more per half year by way of a higher dividend, to which there was no objection. In course of time, the amalgamation would result in a cheaper supply; and there would be various economies by concentrating the manufacture of gas. Three-quarters of all the saving by the operation of the sliding-scale went to the consumers. In connecting up the districts, some eleven miles of mains would have to be laid. The Bishop's Stortford Company had been paying dividends of 5 and 6 per cent., the Epping Company had paid 5 and 5½ per cent., the Harlow and Sawbridgeworth Company 5 per cent., the Ongar Company 9 and 10 per cent., and the Newport Company 5 per cent.; and they had carried to reserve a sum equal to 2 per cent. per annum. The total share capital was £104,000, the loan capital £14,825, and the additional capital required for the development of the district (including electricity) was £135,432. With regard to the prices to be charged in the inner and outer areas, he said they were asking for power to reduce the price from 1s. to 6d. if it were found that the consumption in a particular quarter had risen to a sufficient extent. The practice of Parliament was against large differentials. They wished to bring the two prices together if it were expedient; and in doing so, Bishop's Stortford would not be prejudiced. It was the price in the inner area which regulated the sliding-scale. The standard price of 4s. was fixed with the Bishop's Stortford Council in 1904; and there were no circumstances now which called for an alteration of this. It was not the practice of Parliament to reduce the price when the public had subscribed capital on the strength of it. With regard to the area of supply, he said the greatest length was 28 miles and the greatest breadth 20 miles; but the district was somewhat irregular, and would be better described as 21 by 15. The population of the districts now supplied by gas at the last census (1901) was 23,500; but there were prospects of a development of the district.

Mr. *H. E. Jones* said that the proposals in the Bill offered the only way by which the little hamlets round the larger centres of population could hope to get gas at a reasonable price. Small, scattered gas undertakings could not pay; they could not employ the labour economically, and they could do nothing with the residual ammonia, which was of considerable value. The proposals in the Bill would ensure a well-managed supply in the district; and it would be at a cheaper rate. His experience was that this kind of amalgamation had generally shown a reduced price to the consumer. The prospect of the small companies, with the competition of cheap American oil, was not a very bright one. There was nothing in the Bill, so far as he could see, that the gas consumer in Bishop's Stortford need apprehend as prejudicing him.

Mr. *E. H. Stevenson* said he acted for the Council in 1904, when the standard price of 4s. was agreed between the Council and the Company. This was a fair price, and nothing had happened to make it now an unfair one. Even if it had been unfair, he thought it should not be altered upon the shareholders who had subscribed money upon the faith of the action of Parliament. It was the keystone of the financial position of the Company; and the effect of altering any standard price would be that intending investors throughout the kingdom would discount the value of stock in future very much, and the consumers would be injured by it. They would not give the same premiums; it would destroy all confidence in gas undertakings. The proposed amalgamation was in the interests of everybody; and it would be more in the interests of Bishop's Stortford than anybody. Upon an amalgamation, it would be necessary to spend some of the capital immediately in Bishop's Stortford. This would be money well spent, because the saving in working expenses by shutting-down some of the other works would be considerably more than the dividend required to be paid upon the capital employed. It would be a great wrong, he thought, to the gas consumers in the outer district that they should always be compelled to pay 1s. more than those in the inner district. He doubted even whether there would be this difference of cost between gas supplied in the one district and the other. There were necessarily advantages in the hands of a gas company which would enable them to generate electricity upon more favourable terms than people who had not gas-works. One of the chief causes was that capital could be raised at a much less rate of interest by a gas company than by an independent company.

Wednesday, March 16.

When the hearing was resumed to-day,

The CHAIRMAN asked Counsel for the promoters to confine their evidence to that from Bishop's Stortford.

Mr. *J. S. Cooper*, of Bishop's Stortford, said that generally there was no opposition there as to the amalgamation of the Companies.

This concluded the case for the Bill.

Mr. BARNARD LAILEY, in addressing the Committee, pointed out that the Local Authority would be seriously prejudiced by the proposals in the Bill. The Council had everything to lose and nothing to gain by the proposed amalgamation. At the present time the Bishop's Stortford consumers were enjoying a satisfactory and reliable supply. This was being given at a moderate price, and the conditions would become still more favourable. They had the strongest objection to being put at the mercy of speculation which might or might not be successful. The existing Company was a prosperous one. The general body of consumers were being supplied at the rate of 3s. 9d. per 1000 cubic feet; and the Council did not think that the new Company would be at all likely to do better than was being done by the Bishop's Stortford Company.

At this stage,

Mr. LAILEY announced that, as a result of negotiations outside the Committee-room, terms had been substantially agreed between the parties.

Mr. HONORATUS LLOYD, after a short interval, remarked that the whole of the opposition to the Bill had been withdrawn; and it had been agreed to insert a clause giving the Local Authority power to purchase the electrical undertaking at the expiration of 21 years from the date on which the supply was commenced, or any subsequent period of seven years upon terms which would be placed before the Committee. Under these circumstances, he asked the Committee to say that the measure should proceed.

The Bill was ordered to be reported.

FARNHAM GAS BILL.

House of Lords Committee.—Wednesday, March 16.

(*Before Lord* HYLTON, *Chairman*, *Lord* LILFORD, *Lord* SEATON, *Lord* CATHCART, *and Lord* TEMPLEMAN.)

This is a Bill by which the Farnham Gas Company seek incorporation and additional powers in connection with their gas undertaking. Authority is also sought for the purpose of supplying electricity.

Mr. HONORATUS LLOYD, K.C., and Mr. CLEASE appeared for the promoters; and Mr. G. J. TALBOT, K.C., and Mr. C. C. HUTCHINSON, represented the petitioners—the Farnham Urban District Council.

Mr. HONORATUS LLOYD, in opening, said the Company was formed under a Deed of Settlement in 1834, with a capital of £3000; the price charged for gas being 15s. per 1000 cubic feet. In 1876, the Company was incorporated as a Limited Company; and in 1899 they obtained a Provisional Order from the Board of Trade. The original capital was £19,200, with a 7 per cent. maximum dividend. The gas supplied was to be 15-candle power; and there was a maximum price of 3s. 9d. In 1900, the Council decided to apply to Parliament for power to purchase so much of the undertaking as was within their limits; but the ratepayers were against it. The Council then sought powers to supply electricity; but this was refused. The Gas Company were now asking for authority to supply electricity, because, among other reasons, they could generate more cheaply. The objects of the Bill were to incorporate the Company as a statutory concern, to prescribe the capital of the Company, to confer additional capital powers and borrowing powers, to sanction the utilization of additional lands for the Company's purposes to extend the limits of gas supply, to substitute the sliding-scale with a standard price and standard dividend in lieu of the maximum price under which they worked at present, to reduce the illuminating power from 15 to 14 candles, and other ordinary powers. For gas only, the total authorized share capital was £49,200, and loan capital £12,300. Of this £49,200 authorized, there was issued £29,200, and of the loan capital there was issued £6800. Of the share capital £20,000, and of the loan capital £5500 remained unissued. By the Bill, they were seeking, for gas and electricity, a total share capital of £60,000, and £20,000 loan capital. Deducting the share capital issued and the loan capital raised from the total amount to be authorized, it would leave for issue in the future £30,800 in respect of share capital and £13,200 in respect of loan capital. In 1899, when the Company obtained their Provisional Order, the Board of Trade preferred that they should have the old-fashioned system with regard to price and dividend; but it was provided in the Order that they might apply for the substitution of a sliding-scale. With regard to the reduction of the candle power from 15 to 14 candles, there was no doubt a saving of a fraction of a penny; but if the standard price were to be reduced by reason of this, it would be an injustice. The average price charged had been 3s. 6d.; and they had been able to pay a little more than 5 per cent. dividend. But if they had had a maximum dividend, they would have had to charge 3s. 8d.; and if there had been anything put to reserve, the charge must have been 3s. 10d. It was an extraordinary proposal that the Urban Council should come and ask for the price

to be fixed at 3s. 9d. They also asked for a calorific test. No one was satisfied that this could be done properly. The London County Council had been endeavouring to find some satisfactory method; and last session the Gaslight and Coke Company agreed that they would have the test inserted in their Bill. This was done because of the special experiments which had been carried on in respect to their particular gas; but it was ridiculous to suggest its application to a small Company like this. The Council also asked for the provision of a testing-station on their own premises; but there was the Company's station within a few yards of the Council's offices, and they had only made use of it three times in four years, and on each occasion the test was satisfactory.

Mr. *E. Herbert Stevenson* then gave evidence. He said that the Company were not asking for anything new for gas capital powers. The capital which they had for gas would not last for very many years, because the growth of the undertaking was so rapid. He did not think that the supplying of electricity would seriously affect the Company's output, as there would not be a very large consumption of electrical energy. In the next eight or nine years, the Company would have considerable expenditure; and the powers asked for in the Bill would not carry them on for more than eight or ten years. The standard price of 3s. 9d. was a fair and reasonable one. In fixing the price, they had to take into consideration what the price of gas had been in the past, and the dividends the Company had paid. The average dividend paid was 5⅛ per cent. The Company might have kept the price up at 3s. 9d. and paid the maximum dividends; but they entered into a contract with the Council for public lighting, under which the price charged was 2s. 3d. If the power were reduced from 15 to 14 candles, the saving would not be more than §ths of a penny. With regard to the calorific test, it should not be put upon a company bearing a penalty while the company still had the illuminating power test, also bearing a penalty, because the illuminating power test and the calorific value test would practically be identical. Until it was known what different coal would do in calories, it ought not to be put upon the Farnham Company. He regarded the suggestion of a separate testing-station as absurd. There could be no complaint about the Company in any way whatever.

Replying to Mr. TALBOT, witness said he agreed that the Company were in a good financial position; but it was not such as to admit of a reduction in the price of gas. It had never been a practice to reduce the price of gas because of the reduction of 1-candle power. Asked if the test for illuminating power was of no value with regard to the calorific power of gas, he said that they now knew the calorific power of 15 and 14 candle power gas. A reduction of the illuminating power meant a reduction of calorific power. The effective proportion of gas used was so slight that a very large reduction of candle power did not very much affect the consumer. He had tested gas through the incandescent burner with 15-candle and with 10-candle gas, and could not tell any difference in the photometer. He thought the calorific power test would certainly come. He did not know of a single company being compelled by Parliament to reduce its price when the reduction had been only 1-candle power. The difference to the consumer in this case, whether from the point of view of illumination or heating, would be a negligible quantity.

Mr. *Frank H. Jones* gave similar evidence. He considered the works were in a good condition. If the Company were to be penalized for reducing the illuminating power from 15 to 14 candles, he would strongly advise them not to lower it. The setting-up of a testing-station at the Council offices would be most unreasonable.

Mr. *Charles Hunt* then gave evidence on behalf of the petitioners, with regard to the standard price. He agreed that the plant was in very good order, especially the carbonizing plant. All things considered, there was no doubt the Company could maintain the price and the dividend at their present figures, and there were reasonable prospects of reducing the price of gas.

Mr. TALBOT briefly addressed the Committee on the question of the standard price, and asked that it should be fixed at 3s. 4d.

Mr. HONORATUS LLOYD, in reply, dealt shortly with the matter of the standard price, contending that 3s. 9d. was a fair price.

The Committee, after a short consultation, found the preamble proved, subject to the substitution of 3s. 6d. for 3s. 9d. as the standard price.

GOWERTON GAS BILL.

This Bill was last Thursday before a Select Committee of the House of Lords, presided over by Lord HYLTON, and composed as was that on the Farnham Gas Bill.

Mr. WEDDERBURN and Mr. F. N. KEEN appeared as Counsel for the Gas Company; and the petitioners, the Swansea Rural District Council, were represented by Mr. G. M. FREEMAN, K.C.

Mr. WEDDERBRUN, in opening the case for the Bill, stated that it was to incorporate as a statutory Gas Company, a limited Company which might be described as just starting, and also to define the area of the statutory Company. The Gowerton Company was just emerging from a certain amount of difficulty. The limited Company was formed in 1907 with a capital of £15,000, of which half was to be in 7 per cent. preference shares of £5 each, and the rest in ordinary shares of £5 each with a limited dividend. The Company was formed by a Mr. Eaton, who was a company promoter; and he floated the Company with the assistance of Sir Charles Soames, three local men, and an engineer. The local Directors, owing to something which they ascertained was going on in a neighbouring Company, became suspicious of their fellow Directors and of the promoter, Mr. Eaton; and they were not content with a proposal that was made to sell certain gas plant to the Gowerton Company at what appeared to them to be a very high figure. In December, 1908, the local Directors consulted Messrs. Aaron Thomas and Co., Solicitors, pointing out that things were not as they should be, and it was desirable that an action should be brought. This action was settled on terms which were satisfactory to the local Directors. Mr. Eaton ceased to have anything to do with the Company; and Sir Charles Soames later retired from the directorate. Instead of the Company buying plant for the fancy figure of £5000, they bought it on valuation for £655. Now the Company was in an entirely satisfactory condition; and they had entered into an agreement with the Swansea Rural District Council—the district of supply being in that Council's area. The agreement was really one which the Rural District Council had no power to make, because although a non-statutory Company could not break up the roads without the assent of the Rural District Council, the assent of the Council was a very limited thing. They could give assent so far as it might be necessary for public lighting; but they had no power to license a non-statutory Company to break up the roads. When the agreement was scheduled to the Bill, the Lord Chairman objected to it; and it was struck out. The only petition against the Bill now was that of the Swansea Rural District Council, inasmuch as three other petitions had been agreed, and a fourth had been dropped. The contention of the Gas Company was that the the Rural Council did not represent the gas consumers. The Council strongly objected to the proposals in the Bill in regard to the capital and to the dividend the Company were to be at liberty to pay. The Company were asking for exactly the same capital (£15,000) as it was under the agreement which the Rural District Council had signed and agreed to. When the Company became a statutory Company, they proposed that there should be the limit, which the general law gave, of 10 per cent. dividend. But the Council were asking that it should not exceed 7 per cent.; and they also asked to have divided up the original capital to be spent in the first ten years, which was, of course, unheard of. They also asked to apply the auction clauses to some of the capital. There was a question, too, with regard to two districts, Cockett and Penderry, which the Company asked to have included in their limits of supply in accordance with the agreement arrived at with the Council in September last; but the Council were now asking that these districts should not be given to the Gowerton Company.

Mr. *E. Herbert Stevenson* was the first witness called in support of the Bill. He pointed out that this was a rapidly-growing district, and that a supply of gas would be a great advantage. The Company had already erected a small gas-works, and had about 200 consumers: and they were still receiving applications for a supply from many other people. The Company was in its infancy, so to speak; and was coming to Parliament now for the first time. The total manufacture of gas at present was only 10,000 cubic feet per day. It was the custom of Parliament where a company was just starting to give it a sufficiently reasonable capital to carry it on for ten or twelve years; but it was not the custom to divide up the original capital. Perhaps 75 per cent. of the consumers were under the prepayment-meter system—the population being purely a working-class one; so that the capital expenditure would necessarily be higher than in the case of the ordinary type of company. With his experience of the Swansea Gas Company, he would say that they did not propose to supply the districts of Penderry and Cockett. The promoting Company had expended £200 on the site, £3500 on works, £750 on mains, and £1200 for the installations in the houses. As to the auction clauses being applied, as was suggested, to part of the capital, there was no precedent for applying them in the case of a company which was just starting its career. He did not know any case of a company coming to Parliament to begin a gas undertaking that had not received power to raise its original capital at 10 per cent. As agreed with the District Council, the maximum price was fixed at 4s. 6d. per 1000 cubic feet for the first few years and afterwards at 4s. 3d.

The CHAIRMAN here pointed out that there was no report from the Board of Trade or the Local Government Board either with regard to the 10 per cent. dividend or the application of the auction clauses; and his experience was that these were matters which they never omitted to call attention to.

Mr. FREEMAN said that if the Committee had made up their minds with regard to these points, he would not pursue them further. Proceeding to address the Committee on behalf of the Rural District Council, he remarked that his objection was now reduced to one point—that of the apportioning of the district. The Council were there as the public authority to protect the public interests; and they considered that it would be more in the public interests and the interests of their consumers that the Swansea Gas Company should be allowed to supply the districts of Penderry and Cockett. The Swansea Gas Company were old-established and well-to-do; and they were quite prepared to spend money on a district of this kind.

Evidence was given in support of the petition by

Mr. *Edward Harris*, the Clerk to the Council, who pointed out that the question of these two districts was raised in the Swansea Gas Order when before the Board of Trade a few days before; and Mr. Pelham then decided that, as the point was raised in the present Bill, he would leave it to the Committee to decide whether these two areas should go to the Gowerton Company or not. According to the Committee's decision, the point in the Swansea Gas Order would be determined. The Swansea Company were charging 3s. to the private consumer and 2s. 10d. for public lighting, whereas the prices proposed in the Gowerton Bill were 4s. 6d. for the first few years and then 4s. 3d.

In reply to Mr. KEEN, witness agreed that the Swansea Company had power to charge 5s. maximum within certain limits.

Mr. KEEN having briefly addressed the Committee in reply,

After a consultation in private, it was decided that although the Committee passed the preamble of the Bill, the districts of Penderry and Cockett would be struck out of the limits.

Monte Video Water-Works Company.—The Directors report that for the year 1909 the gross receipts were £135,579, an increase of £12,255 on those in the preceding year, and the net receipts £93,247, or £11,857 more. They propose to pay a final dividend of 5 per cent., making 8 per cent. for the year, tax-free. They place to the depreciation fund £5000 and to reserve fund £10,000; the balance to be carried forward being £34,103. The ratio of working expenses during the year was 31·22 per cent., against 34 per cent. in 1908. The Company's new works were formally inaugurated in September; the ceremony being attended by the President of the Republic, four of his Ministers, and a large number of prominent officials of the city.

LEGAL INTELLIGENCE.

INVESTMENT OF A GAS COMPANY'S RENEWAL FUND.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, March 16.

(*Before Mr. Justice* SWINFEN EADY.)

Schweder v. Gardner and Others.

This was an action by a shareholder in the Worthing Gas Company, on behalf of himself and all other stockholders, for an injunction ordering the Directors to invest in Government or other securities the moneys which had been appropriated, under section 32 of the Company's Act of 1907, to the renewal fund, and also for a declaration that they are bound to invest, and keep invested, all sums that are so appropriated.

Mr. MACNAGHTEN, K.C., and Mr. BRYAN FARRER (instructed by Messrs. Kekewich, Smith, and Kaye) appeared for the plaintiff; Mr. FRANK RUSSELL, K.C., and Mr. COZENS HARDY (instructed by Mr. John Hands, agent for Messrs. Verrall and Son, Worthing) represented the defendants.

Mr. MACNAGHTEN having stated the facts of the case, which will be found in the judgment, and read a good deal of the correspondence between the parties,

Mr. RUSSELL submitted there was no obligation on the Directors to invest the renewal fund at any particular moment. It must be in their discretion; and they must have time to select a suitable investment. He also pointed out that the declaration asked for—viz., that the Company were bound to "invest and keep invested" the fund—would entirely destroy the object with which it was formed.

Mr. *William Cash*, F.C.A., one of the defendants, said he was elected a Director of the Company in 1908, having previously advised the Board. He was connected with various gas companies, and was familiar with the preparation of gas accounts as provided by Statute. For the half year ending June, 1908, the Directors for the first time appropriated out of revenue £730 to the renewal fund; in the following half year they appropriated £365; and the same amount for the six months ended June last—making, with interest, £1506. They considered it advisable to create this fund, looking to the fact that they were authorized by their last Act to acquire a new site, to which they would ultimately have to transfer their works. The Company were under the sliding-scale. The sums appropriated were not invested, but remained in the general business of the undertaking. The policy of the Board, in which he concurred, had been to keep down the capital as much as they could, and sell gas as cheaply as possible for the benefit of both the Company and the public. This was the first reason why the sums appropriated were not invested. The second was that the Company had not funds available to purchase securities; the capital account being, in fact, overdrawn, and the revenue being used for capital purposes. The third was that they were engaged in a certain amount of exceptional renewals of mains, &c., which, under the terms of the Act, might have been charged to the fund, and they had no desire to invest money when it was possible they might have to sell out again almost immediately. A time came when the raising of further capital was necessary; but the Directors, acting in the best interests of the Company, deferred it as long as possible. Witness put in a statement showing the amount of cash available at the dates of various Board meetings, beginning with July, 1908, when, after deducting the dividend then recently declared, the balance was only £130. On some occasions they were actually overdrawn at the bank. On Aug. 21, 1909, the shareholders at the half-yearly meeting authorized the creation of further stock; and on Sept. 25, the Directors resolved to offer it for sale. On Nov. 23, £4085 of stock was sold, producing £4285, less expenses; and on the same day a resolution was passed for the investment of the renewal fund in India 3½ per cent. stock. This was one of the reasons for the issue of the stock.

Cross-examined: During the years in question, considerable sums were expended out of revenue on capital account. After raising the £4000 odd last November, the capital account was still overdrawn. If the Directors had thought fit, they could have borrowed money from their bankers, and invested the renewal fund, thus technically complying with the section; but this policy did not commend itself to them. It would have been borrowing money at 5 per cent., possibly on the security of the very investments themselves, which yielded a lower interest—which did not seem to him to be a satisfactory way of doing business. There was no danger now of having to resort to this fund for exceptional renewals, as the Company had just come to an end of a considerable expenditure on mains, which had been made out of revenue. Ultimately they would have to raise some £8000 further capital, but not at once. He told the plaintiff shortly after the annual meeting that further capital was going to be raised, out of which the investments would be made; but until then they were not in a position to make them. He could not say that the pressure brought by the plaintiff had caused the investment in November. Personally, he was disposed to wait until the action had been tried; but ultimately it was decided to adhere to what had previously been determined, and make the investment as soon as the funds were available.

This concluded the defendants' case.

Mr. MACNAGHTEN having addressed the Court briefly in reply,

Mr. Justice SWINFEN EADY said the action raised a short question as to the true construction of the Worthing Gas Act of 1907. Sections 30 and 31 provided for an insurance and a reserve fund, and section 32 for a renewal fund; and upon the true construction of the last section the question turned. This section empowered the Directors, if they thought fit, to accumulate, by a renewal fund, annual appropriations out of revenue. The amount so to be set aside each year was limited, as was also the maximum amount to be accumulated; and the fund might be used for the renewal and repair of the works, mains, and pipes. Until it was required for this purpose, however, it was to be "invested in Government or other securities," and the dividends and interest arising from the securities were also to be "invested in the same or like securities and accumulated." In his opinion, it was incumbent upon the Company and the Directors to make a separate investment of this renewal fund, and not merely allow it to remain represented by some indefinite part of the general assets of the Company. In other words, the Statute required that it should be a separate fund actually available when required for the purpose of these renewals, and that it would not be a compliance with the Statute merely to have a nominal setting aside in the books of the Company, and say that this fund was represented by some indefinite part of the assets of the Company. The language of the section, in contrast with that of the two previous sections, made it quite clear that it was the duty of the Directors so to invest. It appeared that for three successive half years, beginning with June, 1908, certain sums were set aside each half year, apparently a sum intended to be the maximum amount, or almost the maximum amount—£730 for the first half year and a moiety of this sum for each of the succeeding periods. The sums so set aside had not been separately invested in August, 1909, and thereupon the correspondence material to the action began. A letter written just after the issue of the writ (in November) expressly stated that the Directors did not assent to the view that they were bound to invest the sum in question in Stock Exchange securities either then or at any other time. He (his Lordship) thought this meant that they were not bound to invest the fund separately, apart from its being represented by the general assets of the concern. The letters were rather in the form of putting the plaintiff off. Mr. Cash had given evidence as to the circumstances under which there was delay in making the investment; and he (his Lordship) quite accepted what had been said, and was satisfied that the Directors had been acting *bonâ fide* in what they thought were the best interests of the Company. He quite appreciated the witness's point, that it seemed inexpedient to borrow money or otherwise obtain it at a high rate of interest, and then invest it for the purposes of the renewal fund at a lower rate, as, from a commercial point of view, it would be looked upon as bad business. But the first answer to this was the Statute. The obligation upon the Directors was to set aside this renewal fund and to separately invest it. One could quite appreciate Mr. Cash's view, that it was expedient to keep the capital in a gas company as low as possible. But, on the other hand, capital was being expended, and the revenue was being used for the purpose; and if it was necessary to make capital expenditure, it became necessary to raise capital in order to provide for it. He thought the plaintiff was justified in bringing the action; and he proposed to make a declaration that the defendants were bound, pursuant to section 32 of their Act of 1907, "to invest in Government or other securities"—omitting the words "and keep invested"—"all moneys which might at any time be appropriated by them out of revenue for the purpose of the renewal fund mentioned in the section, and to accumulate the dividends and interest arising from such securities in accordance with the provisions of the said section, until occasion may require any portion of such fund to be appropriated and used for the purposes in the section mentioned." The Company were not bound to keep it when it was wanted for a statutory purpose; but until it was so wanted, it must be invested. It was not necessary to grant an injunction. He only determined the legal rights of the parties by making the declaration; and it followed that defendants must pay the costs of the action.

DAMAGES FOR A GAS EXPLOSION.

In the Shoreditch County Court, last Thursday, his Honour Judge SMYLY, K.C., delivered his considered judgment in the case of *Medcalf v. Staines and Son*. The plaintiffs were Percy Medcalf and his wife Bertha, of Priory Avenue, Walthamstow; and they sued Messrs. Staines and Son, of Great Eastern Street, E.C., builders, to recover £31 9s. 10d. for personal injuries and damage done to furniture from an explosion through a workman having left a gas-pipe unsealed, which had caused a leak between the ground floor and the first floor.

The male plaintiff's case was that he had charge of a National Telephone Exchange at the address where he was now living; and it was decided to have the place redecorated for his convenience. The workmen of the defendants came in; and Medcalf and his wife then went away for a holiday. On the evening of their return, they went up to the bedroom, and struck a match, whereupon there was a terrific explosion. The windows were blown out, and the furniture was set on fire. Medcalf had the right side of his head and face badly burned, while his wife received such a serious shock to the system that it was alleged she had not recovered even now. At the time of the explosion, the men had left the premises, having completed their work. For the defence, it was suggested that during the progress of the work the plaintiff told a painter to remove a pipe that was sticking out of the wall, which he did, not knowing at the time that it had a cock on it, and was connected direct with the meter. The man forgot to tell the foreman; and the pipe was left open. It was contended that the explosion was therefore caused by the plaintiff's own carelessness in directing the man to remove the pipe.

His HONOUR, in giving judgment, said he found that the contract for the repairs of the house which the plaintiffs were about to occupy was between the defendant and the National Telephone Company. While the work was being done, the male plaintiff told one of the workmen to remove the pipe. This workman was not a foreman. The workman pulled down the pipe, which ran down the corner of the room. This pipe had a proper cock upon it; and, if it had been left in its place, there would have been no escape of gas. When the pipe was pulled down, a gas-pipe behind the plaster of the ceiling was left open; so that immediately the gas was turned on at the meter, there would be an escape. The repairs to the house were completed; and defendants' foreman and his men left the premises. Part of the work included in the defendants' contract with the Company was to connect all the gas-pipes in the house with one meter. Before the repairs were carried out, there had been two meters; and this particular pipe had been

attached to the meter taken away. When the plaintiff came to the house, the foreman had gone. There was no evidence given to prove who turned on the gas. Medcalf denied that he did; but as the full width of the gas-pipe was open, he (the Judge) thought that the meter could not have been turned on more than a few minutes or the house would have been full of gas, whereas the trouble was confined to a small part of the house. His finding would, however, have been the same, even if the plaintiff was proved to have turned the gas on, as that would be a most ordinary and reasonable thing for a man to do who required light. The workman was negligent in not telling his foreman what he had done; and the foreman was negligent in not testing whether the connections were right before leaving the job. If the foreman had turned the gas on at the meter, the escape was such a big one that it must have been discovered by watching the dial. The question on these findings was, Has defendant committed a breach of duty apart from his contract? If the negligence of his servants was only a breach of contract, he was liable to those only with whom he had contracted; but if he had been guilty of a breach of duty, he was not protected from liability by setting up a contract with another person in respect of the same matter. In *Parry v. Smith*, the late Lord Lopes, then Mr. Justice Lopes, held that a duty attached in every case when a person was using or dealing with a highly dangerous thing, which unless managed with the greatest care was calculated to cause injury. The subject-matter of that action was damage to a servant by a gas explosion caused by defendant's negligence in carrying out a contract with the master of the servant. It was the nature of the work which, being dangerous to others, distinguished this case from *Colles v. Sellar*. His verdict would therefore be for the plaintiffs, for £21 and costs.

WATER SUPPLY FOR RAILWAY STATIONS.

In the "JOURNAL" for the 1st inst. (p. 598), we gave the arguments in an appeal, heard by Justices Phillimore and Bucknill, by the Metropolitan Water Board against a decision of his Honour Judge Woodfall, at the Westminster County Court, in a case in which the question raised was whether the supply of water to railway stations for the purpose of being used in water-closets and urinals was a "domestic" use within the meaning of the Act. At the close of the arguments, judgment was reserved; and it was delivered last Tuesday.

Justice PHILLIMORE said the action was brought to recover the sum of £12 as a water-rate levied upon the London, Brighton, and South Coast Railway Company in respect of water supplied to the urinals and closets at their station at West Norwood; the rate being calculated under section 8 of the Metropolitan Water Board (Charges) Act, 1907, at 5 per cent. on the rateable value of the "house or building, or part of a house or building," in respect of which the supply was required. The claim of the Water Board was made on the ground that the water was supplied for "domestic purposes;" and it was resisted by the Railway Company (who preferred to pay by meter), who contended that this was not a domestic purpose, but was, if anything, a railway purpose under section 25 of the Act. A number of decisions upon the words "domestic purpose" or "domestic use" (the latter being the expression in section 35 of the Water-Works Clauses Act, 1847) had determined that if the actual use to which the water was put was domestic, it did not matter whether the householder was providing the means of domesticity as part of a profitable business or as carrying out a public duty. The last decision—that of Mr. Justice Neville, in the South Suburban Gas Company's case*—appeared to have carried the matter farther. He held that the Gas Company, in respect of buildings, offices, and works extending over 40 acres, where 400 people were employed, were not entitled to claim to pay by meter for water supplied to their workpeople for drinking, washing, and sanitary purposes, but must pay upon the annual value of the premises. It was not necessary for them to say whether, in a precisely similar case, they would follow this judgment. But he thought it went to the very verge of the law; and he would suggest that, if it were to be criticized, criticism would fasten upon the assumption that the purposes for which the water was used—for, at any rate, the water was used in the sanitary conveniences—was necessarily a domestic purpose. It should not be assumed that "domestic" meant civilized or domesticated, or something appertaining to man. It meant something to do with man, as occupying or using a house or dwelling. It did not seem to follow that the use of sanitary conveniences in some public place, or some place of temporary resort during a journey, was domestic. That the use of public sanitary conveniences was not to be paid for as for a domestic purpose, either generally or under this particular Act, was conceded by Counsel for the Water Board, who said that the flushing of these conveniences might come under section 25 as being either "cleansing sewers and drains" or "flushing drains by means of any apparatus discharging automatically." It might be so. But if the purpose was, to use the language in the Gas Company's case, *primâ facie* domestic, the fact that the use of the water also kept the drains clean seemed to be on a par with the fact that the owner of a boarding-house made his house convenient by providing suitable sanitary accommodation. To put it in another way, if the words he had quoted in section 25 overrode the provision as to domestic purposes in section 8, why should not the words "railway purposes" in the first-named section also override the words "domestic purposes" in the other? The expression "railway purposes" might override the words "domestic purposes," as the words as to flushing the drains might override them; and it might do so if every attention to the calls of Nature was a domestic purpose. He preferred to construe this expression as a statutory indication in both cases that domestic purposes meant only the use of sanitary conveniences as part of the house in which the person using them was residing. On the whole, therefore, he thought the appeal failed.

Justice BUCKNILL said the question was whether the County Court Judge was right in holding that the water supplied by the appellants to the railway station in question, at which there were only the usual waiting-rooms, booking office, and conveniences, was not supplied for "domestic" but for "railway" purposes within the meaning of the Metropolitan Water Board (Charges) Act, 1907. Until the Act came into force, the water supplied to the station for flushing and cleansing purposes was always charged for by meter. The appellants' contention, however, was that the water was supplied for "domestic purposes," in which case the charge would be a percentage on the principle of rateable value. The figures were unimportant for the purpose of this case. Urinals and water-closets were as necessary a part of a railway station as they were of a dwelling-house; and it might be assumed that at this station only such arrangements had been made as were necessary for the convenience of the public using it in the way of the Company's business. The question, therefore, was whether the water was, in the circumstances, supplied for "domestic" or for "railway" purposes, or for a "business," within the meaning of the Act. If the only question for the decision of the Court was the use of water for the railway staff at the station, he should not be prepared to disagree with the language of Mr. Justice Neville in the Gas Company's case, even if he had not authority to support it, which he thought he had; but he thought there was a great difference between the use of water at a railway station by the staff and that by the public, who used the station either as the paying customers of the Company or as their licensees. Having referred to other cases relied upon by the appellants, his Lordship then proceeded to give his reasons for coming to the conclusion that the use of water for flushing the urinals and closets set aside for the public at the station in question was not a use of it for "domestic purposes." In the first place, he said it would be an exaggeration of the ordinary meaning of the word "domestic" to apply it to the mere act of washing hands or using the offices in question; and it could hardly be contended that the use of a street convenience would make the water employed there for flushing a use for "domestic purposes." In neither case could it be said that there was any element of domesticity; and in neither was there any abiding or staying in the place where the water was used. The Court were, no doubt, bound by the cases in which it had been decided that the proper test was the character of the purpose, and not that of the place. But this test begged the question here, because in all those cases—even in that of the Gas Company, which had, he ventured to think, gone a little farther than any other—there had been a daily stay on the premises by the persons using the water for the purposes mentioned. At a railway station, however, the passengers or the public lawfully using it did not remain longer than they were obliged. In his opinion, therefore, the water in this case was used for a railway purpose, just as much as that which washed the platform, or was employed for cleansing other parts of the station; and for these reasons he was of opinion that the appeal failed, and must be dismissed, with costs.

Leave to appeal was granted.

* See "JOURNAL," Vol. CVIII., p. 191.

ACTION TO RESTRAIN BREACH OF AN AGREEMENT.

In the Chancery Division of the High Court of Justice last Friday, Mr. Justice Neville had before him a motion for an injunction to restrain a breach of agreement of service. The plaintiffs were the British, Foreign, and Colonial Automatic Lighting Company, Limited; and Mr. Patterson, who appeared on their behalf, said their principal business was the manufacture and supply of apparatus for automatically lighting and extinguishing street gas-lamps under Gunning's patent. In January, 1907, an agreement was made between the plaintiffs and Mr. Hutchinson, the defendant, under which he entered their service as a commercial traveller, and covenanted that he would not, without their written consent, be interested or concerned in the manufacture or sale, for or on behalf of any person or corporation other than the plaintiffs, of any automatic apparatus for lighting and extinguishing gas-lamps. The agreement contained a proviso that this restriction should continue in full force for two years from its expiration. The agreement was terminable by three months' notice on either side; and in August, 1908, the plaintiffs gave notice determining the defendant's engagement on Nov. 21. Shortly afterwards, however, they found they could not obtain a renewal of their contract with the Barnard Castle Corporation, who had taken over the gas-works, and also with the Gas Companies at Newcastle, Darlington, and Windsor. This was explained when it was found, in February of the present year, that the members of the Bournemouth Corporation had been bombarded with letters and circulars by the defendant, who not only solicited orders, and offered to put up, free of cost, an experimental installation of a pressure system of automatic lighting, which he asserted to be far superior to the clockwork arrangement of the plaintiffs then in use, but stated that he had installed such a system successfully at Barnard Castle, Newcastle, and elsewhere. Mr. Cecil Thompson, who appeared for the defendant, said he was not in a position to deny the foregoing facts (which were stated in an affidavit by Mr. Gunning), and must therefore submit to an injunction until Nov. 21 next, when the two years would expire, and pay the costs. Mr. Patterson said he must ask for damages. Mr. Thompson said his client was only a poor man, and an inquiry as to damages would not result in any benefit to the plaintiffs. Mr. Patterson said he was prepared to make an end of the matter if the defendant would submit to the injunction, agree to pay the costs, and to an inquiry as to damages, the costs of which would, of course, be reserved. If this order were made, an appeal *ad misericordiam* might be considered by the plaintiffs. Mr. Thompson having intimated that he could not consent to an order in this form, his Lordship said in that case there would be simply an interlocutory injunction.

In the report of the proceedings at the annual meeting of the Felixstowe Gas Company which appeared in the "JOURNAL" for the 1st inst. (p. 605), it was stated, with reference to the successful lighting of the Spa Pavilion by the Company, that it cost the Council less than it did the previous year to light "the band-stand alone" by electricity. The words should have been "band-stand and enclosure."

MISCELLANEOUS NEWS.

INCOME-TAX ALLOWANCE FOR DEPRECIATION.

The appeal on behalf of the Whitchurch and District (Hants) Gas Company for an allowance in respect of depreciation by way of decreased value of plant and machinery by reason of wear and tear, heard on the 12th of November last and adjourned, was further argued before the General Commissioners at Whitchurch last Wednesday.

Mr. W. A. Schultz, F.C.A. (50, Cannon Street, E.C.) appeared on behalf of the Company, and contended that as gas-works under the Revenue Act of 1866 were assessable according to the rules prescribed by Schedule D of the Income-Tax Act, 1842, they were entitled to claim the benefits of the provisions of section 12 of the Customs and Inland Revenue Act 1878, which provides:

> The Commissioners for General or Special Purposes shall, in assessing the profits or gains of any trade, manufacture, adventure, or concern in the nature of trade, chargeable under Schedule D, or the profits of any concern chargeable by reference to the rules of that schedule, allow such deduction as they may think just and reasonable as representing the diminished value by reason of wear and tear during the year of any machinery or plant used for the purposes of the concern.

Mr. Schultz claimed that this provision was still further strengthened by the Finance Act of 1907, section 26, which provides:

> For the purpose of enabling deductions for wear and tear to be allowed by the Additional Commissioners, claims in respect of those deductions shall be included in the annual statement required to be delivered under the Income-Tax Acts of the profits or gains of the concern for the purpose of which the machinery or plant is used; and the Additional Commissioners in assessing those profits and gains shall make such allowances in respect of those claims as they think just and reasonable.

Also that such allowances are defined in sub-section 4 of the same section, as follows:

> In this section the expression "Deduction for Wear and Tear" means the deduction allowed, or which would be allowed, under section 12 of the Customs and Inland Revenue Act, 1878, as representing the diminished value, by reason of wear and tear during the year, of machinery or plant used for the purposes of any trade, manufacture, adventure, or concern.

Mr. Schultz contended that the only question for the Commissioners to decide was, not whether any allowance should be made, but what allowance was fair and reasonable.

The Surveyor on behalf of the Crown claimed that no allowance whatever should be made until the plant or machinery was renewed, when the whole of the cost of the original plant would be allowed as a deduction from revenue.

After consideration, the Commissioners decided that depreciation should be allowed on the same basis as last year—viz.. 3 per cent. on the written-down value of the plant and machinery.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held on Monday last week—Mr. WILSON MAPPIN in the chair.

The report and accounts for the six months ended Dec. 31, which were noticed in the "JOURNAL" on the 22nd ult. (p. 519), having been presented, and the former taken as read,

The CHAIRMAN, in moving their adoption, said that for the first time since the half year ended June, 1907, the profit had been sufficient to cover the amount required for the dividend and leave a small surplus. This was regarded by the Board as being very satisfactory, as when they made the last reduction in the price of gas, which dated from April 1, 1907, it was fully anticipated that the surplus profits, which had from time to time accumulated, would be drawn upon to some considerable extent. He thought it as well that the shareholders should fully understand this, as remarks had sometimes been made regarding the fact that the Company were not earning the full dividend. When he told them that 1d. per 1000 cubic feet represented £14,500 per annum, it would be seen that a very slight variation in the price of gas materially affected the revenue derived therefrom. Owing to the inclement weather, the slight improvement in general trade, and the many additional purposes for which gas was being more and more used, there had been a very substantial increase in the Company's business during the past half year; the additional quantity of gas sold as compared with the corresponding period of 1908 being 107,415,000 cubic feet, or 6·35 per cent. Dealing with some of the principal items of expenditure, the Chairman said £209 less had been paid for coal, although 11,018 tons more had been carbonized. There had also been a saving of £858 in the cost of repairs of mains and services and of £214 in repairing and refixing meters. The following were items of increased expenditure: Purifying, £426; stokers' wages, £507; repairs of works, £268; and there was an increase in the amount required for interest on debenture stock of £336, due to the Company having sold by auction a further £16,500 of stock during last year. On the other side of the accounts, they had additional receipts from gas of £6596, the average price at which it was sold being 1s. 3·04d. per 1000 cubic feet; meter and stove rents, £180; sulphate of ammonia, £355; and earnings of the Company's railway waggons, £103. Coke and tar had, however, produced less by £809 and £529 respectively. The net result was that whereas twelve months ago the deficiency in the amount required for dividend was £5352, there was now a surplus of £208; leaving a total balance to carry forward of £74,976. Tests to the number of 1170 of the gas supplied during the half year had been made by the Corporation Chemist and the Company's officials, and they showed the average illuminating power to be 17·39 candles. That gas for heating, &c., continued to be fully appreciated was shown by the fact that the Company had sold during the six months 1358 gas-fires and 962 boiling and grilling stoves, 187 additional cooking-stoves had been sold and let on hire, and 34 more gas-engines, varying in size from ½ to 130 H.P., had been fixed. He was pleased to say that since the commencement of the year there were signs of improvement in the value of tar products and sulphate of ammonia. It was a great mystery that the latter material was not more largely used as a fertilizer by farmers. Out of an estimated production of 348,000 tons of sulphate of ammonia in the United Kingdom in 1909, no less than 264,000 tons were exported to foreign countries; leaving only 84,000 tons as being used at home. Efforts were being made by the Sulphate of Ammonia Committee, of which the Company's Managing-Director (Mr. Hanbury Thomas) was a member, to induce the Board of Agriculture to encourage its use by means of experiments by the agricultural colleges who work in connection with the Board. In Germany, the Government lent to manufactures every assistance in this direction, with the result that, whereas in 1896 the quantity of sulphate of ammonia used by German farmers was 80,000 tons, nearly four times this quantity—viz., 284,000 tons—was used in 1908. Another go-ahead country was Japan, to which place their exports in 1901 were only 1500 tons, while last year they reached 49,275 tons; showing how the value of sulphate of ammonia as a manure was appreciated.

Mr. B. G. WOOD seconded the motion; and it was adopted.

A dividend for the half year of 5 per cent. on the "A," "B," and "C" stocks having been declared,

Mr. H. FRASER moved a vote of thanks to the Chairman, Directors, and staff.

Mr. T. RICHARDSON, in seconding the motion, referred to the opposition of the Corporation to the Company's Provisional Order for the reduction of the illuminating power of the gas. He asked if it would lead to bitterness or ill-feeling between them and the Company.

The CHAIRMAN said the matter had been before the Board of Trade (see *ante*, p. 599), and the Directors had not yet heard their decision. But, whatever it was, there would be no friction. It would give perfect satisfaction to the Company.

ROCHDALE GAS-WORKS EXTENSIONS.

Glover-West Retorts to be Installed.

At their Meeting last Wednesday, the Gas Committee of the Rochdale Corporation had under consideration a report presented by a Special Sub-Committee as to the equipment of the new retort-house at the gas-works, which forms part of a scheme of extension estimated to cost £25,500.

The Sub-Committee, which included the Chairman (Mr. Walker), after arriving at a decision in favour of vertical retorts, paid visits to London, Sunderland, and St. Helens, to inspect the systems in use there. They now recommended that the installation be on the Glover-West system, and this recommendation, after much discussion, was unanimously adopted by the full Committee. The installation decided upon will carbonize 100 tons of coal per 24 hours, and the cost is put down at £18,000. In addition to this, there will be the cost for the foundations, the construction of a high-level road, a coal-store, and a new chimney-stack, making the above-named total of £25,500.

It was submitted by the Sub-Committee that there were many advantages claimed for vertical as compared with horizontal or inclined retorts; the principal being continuous against intermittent carbonization of the coal, a larger make of gas per ton of coal carbonized, a higher calorific value of the gas, an increased yield of residual products, saving in labour costs and improved labour conditions, reduced wear and tear of retorts, and economy in ground area due to the small space required for the site. It was pointed out that the saving in labour costs and the improved labour conditions were very considerable when the cost of working was compared with the older systems, as most of the operations were either automatic or mechanical. Special attention was also called to the noiseless, smokeless, and dustless charging of the retorts. It was further stated that the retorts recommended prevented naphthalene difficulties such as were experienced in Rochdale last autumn, when deposits in the feed-pipes were responsible for numbers of complaints of insufficiency of light.

GAS COMPANIES AND THE PORT OF LONDON RATES.

The inquiry—over which Lord ST. ALDWYN is presiding—into the rates proposed by the London Port Authority (*ante*, p. 746) was resumed on Thursday last.

Mr. FITZGERALD, K.C., for the Port Authority, announced that the result of the conferences that had been held between them and various deputations of traders had been eminently satisfactory. He thought that in 27 cases out of 28 agreements had been arrived at as to the rates in the schedule which would be laid before his Lordship.

The CHAIRMAN: Do you mean that in these 27 cases all the objectors have been satisfied?

Mr. FITZGERALD: In these 27 cases the objectors have been satisfied—all those who appeared at the conference.

The CHAIRMAN: I must reserve the objections of those who did not appear at the conference for consideration.

Mr. FITZGERALD said that Mr. Freeman, who represented Gas Companies, wanted him specially to state that, on the question of residuals, an agreement had been come to.

Mr. NEVILLE said he appeared for the Gaslight and Coke Company, and wished to make an observation with regard to the agreements. If the ultimate Order was approved by the Board of Trade in respect to these rates, there was no further question about it; but if the Board of Trade, in their ultimate decision upon the rates, should alter or increase them, he would like to reserve, on behalf of his clients, the full right

to oppose, if necessary, before Parliament when the Provisional Order came up. He desired that his clients should not be prejudiced in any way if the rates were altered or increased.

The CHAIRMAN: I suppose that applies to everybody?

The SECRETARY (Mr. Farrer) then read out the lists of the interests in whose cases the rates had been agreed; and the report of the conference was next dealt with.

Sir *Hudson Kearley*, the Chairman of the Port Authority, stated that the conference was attended by 28 groups, and their suggestions and contentions were considered by his colleagues and himself and dealt with. After going through the suggestions, they were able to arrive at, as he thought, a conclusion satisfactory to all parties. He considered they satisfied everybody, with the exception of the cement trade.

Mr. HONORATUS LLOYD: And it was stated that you hoped to arrive at a settlement which would be a final settlement between all parties.

Witness: Yes; I thought it my duty to make it clear that those who came to negotiate—assuming that they arrived at a decision—should not reappear before the inquiry nor as opponents before Parliament. The list represents accurately the rates agreed to, subject to his Lordship's recommendation.

Mr. NEVILLE said that, on behalf of the Gaslight and Coke Company, he understood that the question of coke did not appear in the schedule at all. It had been agreed to be treated by the Port Authority *pari passu* with coal.

Witness: That is so.

At the conclusion of Friday's sitting,

The CHAIRMAN having revised the whole of the schedule of rates proposed by the Port Authority—in many cases agreed upon in conference by the various trades and industries interested—and having himself fixed the charges for submission to the Board of Trade,

Mr. HONORATUS LLOYD, for the Port Authority, said he thought the only two his Lordship had not dealt with were coal and cement.

The CHAIRMAN: I think I must leave cement at 2d. per ton. Tell me how much per penny does coal produce.

Mr. HONORATUS LLOYD: £30,000.

The CHAIRMAN: I will put coal at a maximum of 2d. That will apply to coastwise and oversea.

Mr. FREEMAN: That leaves the question of coke.

The CHAIRMAN: Coal and coke were put together.

Mr. HONORATUS LLOYD: Mr. Neville yesterday asked Sir Hudson Kearley: "On behalf of the Gaslight and Coke Company, I understand that the question of coke, which does not appear in your schedule at all, has been agreed to be treated by the Port Authority *pari passu* with coal? A. That is so."

The CHAIRMAN: It stands so in the schedule.

Mr. HONORATUS LLOYD: Yes, it is in the schedule.

Mr. FREEMAN: The point was this. Sir Hudson Kearley at the conference stated that, although coke was *pari passu* with coal, it was also not to be higher than Liverpool; and at Liverpool the rate is 2d. for inwards and 1½d. for outwards. As far as the gas companies are concerned, it is all outwards.

The CHAIRMAN: Assuming the rule to be carried out that 2d. maximum would be 1d. actual, and that, further, in the case of coal the export rate is only half the import, you have not much to complain about. Whether it be so or not, I do not know.

Mr. FREEMAN: I only draw your Lordship's attention to what was stated.

The CHAIRMAN: I don't quite understand what you have said. The Liverpool dues, according to this, are 3½d.

Mr. FREEMAN: No; I am told the due on coke is 2d. inwards and 1½d. outwards and coastwise.

Mr. HONORATUS LLOYD: On the Liverpool scale, coal and coke go together.

The CHAIRMAN: I understood so.

Mr. ERSKINE POLLOCK: They are both charged 1d. on the actual payment. I have the table; and it is 1d. for actual payment, coastwise.

The CHAIRMAN: Whatever coal is charged, coke will be charged, too, I gather.

Mr. HONORATUS LLOYD: They both go together.

Mr. POLLOCK: The *maxima* are different at Liverpool; but the charges are the same.

Mr. HONORATUS LLOYD: Nor is there any difference in the Tyne between coal and coke.

The CHAIRMAN: No; I think they must go together.

The inquiry was adjourned.

During yesterday's proceedings, the Draft Provisional Order as amended was gone through, and subsequently certain amendments proposed by the Port Authority were brought up for consideration to be inserted in the second schedule.

Among these were two concerning coal, which were agreed to.

The first was as follows:

Notwithstanding anything in this schedule contained, the maximum rates on coal, culm, patent fuel, coke, coal dust, and cinders imported or exported coastwise into or out of the Port of London, shall be the same as the maximum rate on coal, culm, patent fuel, coke, coal dust, and cinders respectively imported or exported from or to parts beyond the seas.

The second provided:

No port rates shall be charged on bunker coals for steamers' own use on board any steamer entering or leaving the port, and the Authority shall repay any port rates paid on coal imported which shall be used for the purpose of bunkering steamers proceeding beyond the limits of the port.

The inquiry was concluded; and the Chairman will report to the Board of Trade in due course.

As some of our readers may be aware, gas has been substituted for electricity for lighting the Central Railway Station at Brighton. The installation, which is expected to effect a saving of £2000 per annum, is attracting a considerable amount of attention.

GAS FINANCE IN EDINBURGH.

The Finance and Law Committee of the Edinburgh and Leith Gas Commission on Thursday last announced that the following report had been submitted to them by the Convener—Judge Inches.

I have had occasion recently to look into the financial operations of the undertaking, and I have doubts as to whether the policy pursued in the past, particularly as far as the investment of the sinking funds is concerned, is in the best interests of the Commissioners. The present policy is to raise capital by borrowing on mortgages for three, five, and seven years, and to renew these as they fall due, at rates current at the time. The sinking fund moneys, together with the interest thereon, and now the contribution to the special reserve fund, are ear-marked for the liquidation of the capital debt, and are required to be invested in similar securities. The Commissioners may apply these funds at any time they are available for the repayment of the capital debt—that is, mortgages falling due to be renewed can be met by transferring from these funds the equivalent sum, instead of renewing the mortgages and paying an outside party interest. It may be true that we receive a higher rate of interest for money lent on mortgage than we pay for money borrowed on mortgage, but whether the difference is enough to pay the costs, &c., is a doubtful point. As far as I make it out, the interest upon money borrowed is taken from current revenue. The interest received for money lent does not come into current revenue, but goes to help the accumulation of the sinking fund. To this extent, therefore, it seems the present consumers are deprived of some benefit, to say nothing about the local and Imperial taxes which are necessarily assessed on such moneys. In my opinion, the present sinking fund contributions, together with the special reserve fund contribution to the sinking fund, and the fact that the annual amount spent on maintaining the plant is about £25,000 (which in thirty years represents the entire cost of plant and buildings), amply provide for the future, and anything that can be done to relieve the present revenue, and the present gas consumers, should be our object in view. The amount set aside, with interest, for the liquidation of capital in 1908 was £12,256, and for the year ending in May it will not be less than £46,000. In my opinion, it is this sum which falls to be dealt with by the Commissioners, wholly for the benefit of liquidating the capital, either by investment or by repayment of mortgages. If, therefore, any doubt is entertained about the efficiency of the present policy, I venture to suggest that it is a matter which might reasonably be brought before the Finance Committee at an early date.

The Finance and Law Committee remitted to a Sub-Committee to consider and report on the Commissioners' practice as to investing sinking fund moneys, and redemption of annuities and mortgages.

COLONIAL GAS UNDERTAKINGS.

We have lately received the reports and accounts of several Colonial gas undertakings, and take from them the following particulars.

The Auckland Gas Company, Limited—one of the most important of the New Zealand Companies—had last year a revenue of £107,087 from the sale of gas, and a total revenue of £136,143. The expenditure having been £91,443, the balance carried to the profit and loss account was £44,700; and the Directors recommended a dividend for the second half of the year of 9s. per share on the fully-paid shares, and a proportionate dividend on those on which 5s. had been paid. These dividends added to those paid in July amounted to £34,208; and left a surplus of £10,492. At the meeting of the Company held on the 7th ult., the Chairman (Mr. J. H. Upton) stated that the output of gas now exceeded 500 million cubic feet annually; and he therefore took the opportunity of giving the shareholders a short summary of the progress of the Company during the past ten years. He said the total expenditure on capital account had increased from £232,227 to £507,310; the share or nominal capital from £130,855 to £195,482; the premium capital from £72,711 to £153,791; and the total capital paid up from £203,566 to £349,273. The mains had been extended from 134 to 255 miles; the number of consumers had increased from 8100 to 18,136; the quantity of gas sold from 222,639,000 to 500,926,000 cubic feet; and the dividend, from 7s. 6d. to 9s. per half year; while the price of gas had been reduced from 5s. to 4s. 3d. per 1000 cubic feet. The net result of the ten years' operations was to the shareholders an increase in dividend of £5865 per annum, and to the consumers a reduction in price of £18,785 per annum. This reduction being equal to the amount of a rate of 8·3d. in the pound on the assessed value of the City of Auckland. The Chairman added that the Directors desired to acknowledge the devotion of the staff to the Company's interests.

The Brisbane Gas Company had a revenue of £30,019 from the sale of gas, &c., in the six months ended Dec. 31 last; and the amount available for distribution, including the balance brought forward, was £17,107. A dividend of 6 per cent. absorbed £9600; income-tax came to £480; and £7027 was left to be carried forward. The business of the Manly (N.S.W.) Gas Company, Limited, last year was satisfactory, though, of course, the expenditure was increased in consequence of the strike of coal miners; the coal used during the last three months of the year costing, on an average, upwards of 200 per cent. more than usual. There was, however, a sum of £1440 to be disposed of; and the Directors recommended the payment of a dividend of 5 per cent. (free of income-tax). During the past year, a new retort-house was built, and a three-lift spiral gasholder of 250,000 cubic feet capacity commenced, under the supervision of the Manager (Mr. J. A. M'Auliffe). The holder was expected to be ready early in the present year. The Napier (N.Z.) Gas Company, Limited, had a balance of £7010 for the past twelve months, after having paid the interim dividend to the 30th of June; and the Directors recommended a further dividend amounting to £5302, leaving £1708 to be carried forward. The gas sales came to £24,149. Another New Zealand Gas Company—the Wellington—had revenue amounting to £83,709, and a balance of £22,640 on the profit and loss account, for the past year.

PUBLIC LIGHTING AND GAS TESTING IN LIVERPOOL.

Annual Report of the Superintendent.

We have received from Mr. A. G. Smith, the Superintendent of Street Lighting, Gas Examiner, and Official Inspector of Gas and Electric Meters to the Corporation of Liverpool, his report for the past year, from which we extract the following particulars.

Prior to 1894, the lighting and maintenance of the public lamps were entirely in the hands of the Liverpool Gas Company, and the burner in use was of the flat-flame type; but on Jan. 1, 1894, the Corporation commenced to undertake the work themselves—first with the special high-power lamps, and later with the whole of the ordinary lamps. This reorganization realized a saving of £7000 per annum. At that time, the Company's charge to the Corporation was the same as to ordinary consumers; but as a result of an arrangement, following a reference to arbitration, the price was reduced by 10 per cent., resulting in a further reduction in the annual charge of £2500. The Corporation thereupon undertook an improvement in the lighting of the city, and schemes for the reduction of the distances between street-lamps, passage lighting, and incandescent gas lighting were adopted; and in a few years' time Liverpool became, to use Mr. Smith's words, "the best-lighted city in the United Kingdom."

Progress of Automatic Lighting and Extinguishing.

The lamplighters are engaged one hour on each operation, and the lamps are cleaned at least once each week. These arrangements during the past year have employed 14 foremen and 179 lighters; giving an average of lamps per man of 107 in the city, and 89 in the suburbs. The old method of lighting, however, is being superseded by the automatic lighting and extinguishing of the lamps at predetermined times. This system has recently been adopted in Liverpool, upwards of 1000 of these controllers being now fixed in different parts of the city; but, from remarks which have been made, it appears to the Superintendent that the progress of the work in Liverpool is not perfectly understood. He therefore briefly recapitulates the chief points of his report on this subject, submitted to the Lighting Committee on Dec. 17, 1908.

It is estimated that 95 lamp attendants will be required to deal with the 19,000 lamps; their duties being as follows: Inspection of lamps at lighting and extinguishing times, to see that they are duly lighted and extinguished; keeping the incandescent burners clean and renewing mantles, &c., as required; cleaning the lanterns, and winding and setting the clocks weekly. The repairs to the lanterns, &c., will, as heretofore, be carried out by the workshop staff. The new system is therefore only dependent on the controller, lamp attendant, and lamp repairer, whereas the old system is dependent on foreman, lighter, trimmer, lamp repairer, and lamp inspector; thus effecting an estimated saving in labour alone of £8400 per annum.

It is estimated that the capital expenditure will amount to £37,250, which provides for 19,000 controllers, 1500 new lamps, and the conversion of the existing lamps to those of the new storm-proof type; and it was recommended that the new system should be installed at the rate of about 4000 each year—thus taking approximately five years to complete. The Committee, however, considered it desirable to proceed at a slower rate, and about 1000 controllers only were fixed last year; and the same number has been provided for in this year's estimate. The expenditure last year on capital account amounted to £1740, of which £1684 was for material.

Since the fixing of the Gunning controller, the Superintendent has had a new type submitted to him by Messrs. D. Anderson and Co., of London, which appeared superior, as it works instantaneously instead of gradually. It was considered desirable to purchase a number of these; but though the order was placed early in January, deliveries were not commenced until the 7th of September, and it was only at the end of the year that the order was completed. It is therefore too early to form a definite opinion as to their merits; but up to the present they have worked fairly satisfactorily.

The first district to be completed was, Mr. Smith says, that between Lime Street and the Pier Head. It was thought desirable, therefore, that the new districts should be in different parts of the city, to test the controllers under all conditions. Districts have been formed in Old Swan, Aintree, Walton, and Fazakerley; and at the close of the year five of the 95 proposed districts were completed. The number of controllers purchased during the year was 928; bringing up to 1215 the total to date. The number of attendants appointed during the year was three, who took the place of at least six lamplighters previously employed; showing a saving in wages alone of £213 11s. 8d. None of these lamplighters have, however, been dismissed, as vacancies have occurred to which the men have been appointed; and, owing to the erection of new lamps during the year, additional labour was required, and supplied by that displaced in other parts of the city. In addition to the purchase of the controllers, it has been necessary during the year to convert the Bellamy lamps to those of the new storm-proof type; and this has been carried out to the extent of 386 lamps.

The Public Lighting.

The city is lighted by 19,311 lamps—13,089 of them being in the old city and 6222 in the suburbs. The following table shows the number of lamps used in the lighting of streets, courts, and passages.

District.	Streets.			Courts.	Passages.	
	Flat Flame.	Incandescent.	Electric.	Flat Flame.	Flat Flame.	Incandescent.
Old City	231	9,266	275	744	2,338	30
Suburbs	33	5,102	..	..	1,064	1
Total . . .	264	14,368	275	744	3,402	31

Compared with 1908, this is a net increase of 226 lamps; and the total maintenance amounted to £47,818 17s. 7d., compared with £48,347 8s. 9d. during 1908. The lighting of 8½ miles of road was rearranged during the year, involving the erection of 30 double and 45 single incandescent gas-lamps, and the removal of 154 existing lamps to new positions; while 131 lamps were removed to other places owing to the widening of roadways and side-walks, alterations to property, and other causes. Five columns were fixed in lieu of brackets, and 21 new columns in lieu of broken ones. The total length of roads lighted at the end of the year, irrespective of courts and passages, amounted to 463¾ miles—5½ miles being by electricity, 449 by incandescent gas, and the remaining 9¼ miles (principally back streets) by the ordinary flat-flame system. During the year, the department received 3077 reports of failures in the gas supply to public lamps due to the presence of naphthalene, against 3424 in 1908 and 4957 in 1907.

The entire maintenance of columns, brackets, lamps, and fittings is undertaken by the department; and the following among other work was carried out by a staff of 71 mechanics, &c. (the figures for 1908 being given for the sake of comparison).

	1908.		1909.
On district—			
Columns reinstated	247	..	247
Lamps repaired	8,426	..	12,216
,, reglazed	27,207	..	30,236
,, changed	1,989	..	1,600
Visits paid by trimmers to incandescent gas-lamps	179,679	..	159,141
In stores—			
Incandescent gas-burners cleaned, repaired and adjusted, &c.	3,624	..	4,299
New incandescent gas-burners adjusted	957	..	973
Inc. gas-burner chimneys cleaned . .	187,479	..	164,436
Regulators adjusted, &c.	9,540	..	7,370
New regulators adjusted only . . .	720	..	2,170

During the year there were 285 accidents to street-lamps caused by collision with vehicles. In 102 cases the police were able to ascertain the names and addresses of the owners of the vehicles, and accounts for the repairs to the value of £90 16s. 7d. were rendered.

Quality of the Gas.

The following particulars are furnished in connection with the work of testing the gas supplied to the city during the year. This is done daily at the office, and, by arrangement with the Gas Company, in any part of the city at any time without notice to them. The number of tests made for illuminating power was 422—viz., 318 in the office and 104 in the district; and the former showed an average of 20·19 candles and 20·57 candles, compared with 20·37 and 20·63 candles respectively in 1908. The Company are required by their Act of 1868 to supply gas of 20-candle power when tested with a batswing burner consuming 5 cubic feet per hour. On 130 occasions during the year the gas was below the standard, as compared with only 72 during 1908. The maximum and minimum results obtained were 22·69 and 17·36 candles respectively. In addition to the above tests, 318 were made with the "Metropolitan" argand burner No. 2, which the Company, in conjunction with other gas companies, are seeking power to adopt as the standard burner. Mr. Smith reports that the results of these tests show that the illuminating power of the gas is several candles higher than that obtained through the present standard burner. For testing the calorific power of the gas, a Simmance-Abady calorimeter has been in use; and a test has been made by it every day. During the past year, however, a Beasley patent calorimeter was installed, which records the calorific value of the gas each hour of the day and night. During the twelve months, 317 tests were made, showing an average of 640·77 B.Th.U. net per cubic foot of gas, against 660 B.Th.U. net in 1908, which Mr. Smith thinks may be considered satisfactory. There were 557 samples of gas tested for carbon monoxide; the average indicating the presence of 10·8 per cent. This represents an admixture of 18·2 per cent. of carburetted water gas with coal gas, which is in conformity with the Departmental Committee's recommendation on the subject. But as much as 18·4 per cent. of carbon monoxide, representing an admixture of 50·6 per cent. of carburetted water gas, was found at Garston; the average of the tests in this portion of the city being 16·8 per cent., representing an admixture of 43·8 per cent. of carburetted water gas. The Superintendent forwarded the results of all these tests to the Medical Officer of Health. The average results of 571 tests for purity, involving 816 visits to the various works, are tabulated. They show that the average of the sulphur compounds increased slightly last year.

Gas-Meter Testing.

With regard to gas-meter testing, the Superintendent reports that last year was a record one as regards the number of meters tested; the total being 11,829, against the previous record of 10,951 in 1906—the increase being in those of the prepayment type. The fees received, however, were not of a record character; amounting to only £434, compared with £441 in 1906. The following are the details of the year's work:—

	Company's.		Sundry.		Prepayment.
Meters certified	7315	..	517	..	3504
,, rejected	21	..	294	..	178
	7336	..	811	..	3682

The grand total is 11,829, compared with 10,276 in 1908.

Testing of Consumers' Pipes and Fittings.

This work has been undertaken by the department since 1907, as it is considered desirable that a test for ascertaining the soundness or otherwise of gas pipes and fittings in any establishment should be available, owing to the supply of carburetted water gas to the city. The work is undertaken at a nominal charge of 2s. 6d. per meter, and has proved useful. Mr. Smith expresses regret that the work was not appreciated during the past year to the extent he would have wished; only 134 tests having been made. These, however, were sufficient to demonstrate the usefulness of the work, for not 10 per cent. of the pipes and fittings tested could be certified as sound. In 60 of the tests, the gas was escaping at the rate of from 0·1 to 0·9 cubic foot per hour; in 37, from 1 to 4 feet; in 12, from 5 to 9 feet; in 6, from 10 to 15 feet; in 2, from

15 to 20 feet; in 5, from 21 to as much as 75 feet; and 12 were sound. Mr. Smith gives particulars of a number of interesting instances of escapes of gas being found.

FAZAKERLEY GAS SUPPLY.

During the year, the Committee had the satisfaction of inaugurating a gas supply to the area of Fazakerley, but as at the opening in October full particulars were given, the Superintendent does not repeat them in his report; and as the works had, at the time the report was prepared, been in full working order for only about two months, he does not submit any statistics of the working, as figures for so short a period would, he says, be of little value.

EXPENDITURE OF THE DEPARTMENT.

The total charges in connection with the public lighting of the city and the supervision of the gas supply for the year amounted to £52,947, and a revenue of £2802 was derived from the work charged to other departments and bodies; making a net expenditure of £50,145, against £49,337 in 1908.

CALCUTTA PUBLIC LIGHTING.

Corporation Lighting Department to be Constituted.

At the Meeting of the Calcutta Corporation a few weeks since, the Chairman (the Hon. A. Earle) moved that the proposals made by the Special Gas Committee, in a report submitted early last month, for the constitution of a Lighting Department, should be adopted. In doing so, he said that, while he had no inordinate belief in the capabilities of local bodies to undertake works of a commercial character, the situation presented in connection with the public lighting of Calcutta admitted of exceptional treatment. They had had experience of what the Gas Company could do for them in the way of lighting; and he thought it would not be too much to say that the Company had been tried and found wanting. The Corporation, however, had every hope that under the new contract, which would take effect from 1911, the supply of gas would be much more efficient. The annual expenditure incidental to the proposed Lighting Department was reckoned at Rs. 4,17,000, against the present charge of Rs. 5,79,000. There was, therefore, an estimated saving of Rs. 1,62,000. Consequently, the Corporation had a great inducement to establish a Lighting Department of their own; and they were supported in this view by their own expert, Mr. Mansfield.* The brunt of the work would fall upon the Superintendent of Lighting; but it was not proposed to exclude the Chief Engineer from his proper share of supervision. He would only deal with difficult points as they arose. With regard to the purchase of lanterns and burners, the Special Gas Committee were consulting Mr. Mansfield concerning the form of the advertisement; and none would appear until his opinion had been received. The cost of lanterns would, it was proposed, be met from the loan funds in accordance with the opinion of the present Advocate-General. There was one other matter which he had to mention, and it was in connection with the proposal that certain streets should be lighted by electricity. The suggestion was that if it was ascertained as a result of the survey that more than 9000 lamps would be required, they would undertake a small experiment in electric lighting outside the gas contract, which referred to 9000 lamps only, and the Corporation were not bound to the Gas Company in respect of a larger number. If hereafter the Special Gas Committee should definitely recommend that any portion of the city should be lighted by electricity, the resolution passed on May 6, 1908, that all public streets should in future also be lighted by gas, would have to be modified in respect of the streets selected.

The motion having been seconded and the proposal supported, Mr. Apcar said he dissociated himself from it if it was to be decided that the cost of the lamp-posts, lanterns, mantles, &c., was to be met out of loan funds. He moved, as an amendment, that the cost of the experiment should be defrayed from the revenue funds of the Corporation. Mr. Braunfeld remarked that the experiment they were going to try might prove a success or a failure; and after all the past experience of experiments, he was not so sanguine as the Chairman and others with regard to its success. His own view was that the Corporation would not be justified in charging to the loan funds the expenditure under this head; and therefore he should support the amendment. Mr. Wyness observed that if they could not make the contribution from the loan funds, the only alternative was to drop the scheme. Mr. J. N. Mitter said he was against dual administration of gas lighting of the city, as they would not be able to fix the responsibility of anyone in particular for defective lighting. They could do so if the lighting were left in the hands of the Gas Company. The estimate given by the Chairman did not, in his opinion, leave sufficient margin for contingencies, for he was sure they would have eventually to spend more than they had at present estimated for the replacement of burners and mantles. The Chairman, in closing the discussion, said the expert whom the Corporation had consulted on the subject was of opinion that the estimate was very liberal. He agreed with Mr. Wyness in thinking that if they did not meet the charge connected with the new department from the loan funds, they would have practically to drop the scheme altogether. The amendment was rejected by a large majority, and the motion agreed to.

* A report by Mr. Mansfield, containing suggestions for completing the scheme for lighting the city, appeared in the "JOURNAL" for Jan. 4 last (p. 51).—ED. J.G.L.

Walsall Corporation and the Brownhills Gas Company.—The Walsall Corporation Gas Committee have come to an agreement with the promoters of the Brownhills and District Gas Provisional Order by which the Corporation have withdrawn their opposition to the granting of the Order on condition that the Brownhills Gas Company include a clause in it for the protection of Walsall. This will preserve the rights of the Corporation to supply gas in the Walsall Wood district, the Gas Department abandoning the attempt to obtain powers to extend their mains to Shelfield.

TENDERING FOR INCANDESCENT MANTLES.

Tenders were recently asked for, by a gas-supply undertaking in the Midlands, for the mantles used throughout the borough on the public lamps, &c. The specification issued, on which prices were to be based, is certainly a curiosity in its way. Some of its clauses are as follows; the second paragraph being decidedly quaint.

We hereby offer to supply you with the very best quality of mantles which we make on the terms set out below. The mantles are called ..... ; and are made at.....

If you use mantles at the rate of more than eight per burner per annum on the average, we agree to supply the balance without any charge whatsoever provided that only our mantles are used while the agreement is running. The necessary calculations are to be made by the assistant-manager of your gas-works as soon as possible after March 31 each year; and we are to be allowed reasonable facilities for inspecting your books, but we may not insist on any alterations to your lamps, burners, or methods.

We hereby guarantee that our mantles shall give the following illuminating powers when new, and shall continue to do so for at least one month from the time that they are first lighted.

Mantle on Welsbach Co.'s "C" burner passing 3½ c. ft. an hour.....c.p.
" " " No. 4 Kern " 4 " " .....c.p.
" Dacolight inverted " 3¼ " " .....c.p.

Mantles for testing may be taken from any consignment; and, if they fail to give the guaranteed results, the whole consignment is to be rejected and replaced by us free of charge with mantles which comply with our guarantees; and the cost of testing the faulty mantles to be paid by us or may be deducted from any account due or to become due to us.

Our prices for the various sizes of mantles of the very best make delivered at your gas-works, carriage paid, in good order, at our risk, at times and in quantities (not less than two gross at a time) as required by the assistant-manager of your gas-works during the year ending March 31, 1911, are as follows.

[List follows.]

If you make an agreement with us to buy our mantles for two or three years, instead of only one, we will make the following reductions in price: For a two-years agreement..... ; for a three-years agreement..... We also agree to make an allowance of.....per lb. net cash for mantle ash sent to us carriage paid in tins holding about ½ lb. as long as we supply you with mantles on these conditions.

NEW LIGHTING OF KING EDWARD STREET, E.C.

In connection with the opening of the King Edward the Seventh Post Office in August next, the Corporation of London have considerably widened the above-named thoroughfare; taking down the old boundary wall that was erected in the reign of a former King Edward to enclose Christ's Hospital, on which site the new post office has been built. At the meeting of the Court of Common Council last Thursday, consideration was given to a report from the Streets Committee relative to an application on behalf of the General Post Office for consent to the fixing of four lamps on the west footway of the street. The Committee recommended that no objection should be offered, subject to three of the lamps being maintained by the applicants, and to the expenditure of the Corporation for gas consumed in the remaining lamp not exceeding £10 per annum. The recommendation was agreed to. At the same meeting, the Council decided to relight the thoroughfare by removing the old upright incandescent lamps and substituting the newer type of inverted 18-inch lanterns with two burners in each; giving an illuminating value of 150 candles per lamp, or 75-candle power per burner.

In widening the street, the *façade* of the new post office has been brought into bold relief. This, in conjunction with the fact that the public will be using the front of the building for posting purposes, instead of the old building in St. Martin's-le-Grand, has caused a demand for additional lighting; and hence the application of the Post Office authorities. The four new lamps immediately in front of the building will be of higher illuminating value than the remainder of the lamps in the street—viz., three inverted burners each, of 75-candle power per burner.

LECTURE ON GAS BY A LIGHTING INSPECTOR.

An exceedingly interesting lecture on "Coal Gas: Its Origin and Present-Day Uses," was recently delivered, under the auspices of the St. Luke's Institute Students' Association, by Mr. E. P. Ede, the Lighting Inspector for the borough of Finsbury. The chair was taken by Mr. T. Gordon Collins, who, in introducing Mr. Ede, said he was one who, by virtue of the position he held, was thoroughly *au fait* with his subject, and would no doubt give the audience an instructive lecture. We may add, as further evidence of Mr. Ede's capabilities, that he is the inventor of the new inverted incandescent burner which is now being used in the experimental lighting of Victoria Street, for the Westminster City Council, by the Gaslight and Coke Company; and his lamps are employed in the new lighting of King Edward Street.

Mr. Ede dealt with his subject in three divisions: (1) The first uses of coal gas; (2) the invention of the bunsen burner; (3) the introduction of the incandescent mantle. He said gas was first used without meters, and much trouble was caused by its being difficult to assess at a fair value. Quoting the prices charged for gas at various periods, one could not, he said, fail to see the enormous decrease which had taken place in its cost, apart from the fact that a much better light was produced by it at the present time, and it was purer than in the old days. Its introduction was a very troubled one; and many scientific people, among them even Sir Humphry Davy, raised objections to it. As was

usual in the case of many great inventions and discoveries, Mr. Samuel Clegg, who did so much to perfect the discovery, died in complete obscurity, without any public recognition of his work. Those present would be interested in knowing that in St. Luke's parish the first gas-meters were made; and the business was still carried on in the same factory—now, of course, much larger. Reference to the bunsen burner led up to the subject of the use of gas for heating purposes; and Mr. Ede mentioned a visit paid by him last year to Woolwich Arsenal, where a gun 53 feet long, and weighing 24 tons, was being heated by gas. Electricity came into the field, as they all knew, some years ago, and the prospects for gas seemed less favourable than before; but the introduction of the incandescent mantle saved the situation. England's own manufacture of these articles and the importation of them, were immense, as shown by figures quoted by the lecturer; and again it was a proud thing to say that St. Luke's was once more to the fore—it being the first parish lit throughout by the incandescent mantle.

At the close of the lecture, several questions were put to Mr. Ede and answered by him; and he was accorded a hearty vote of thanks.

HARROGATE CORPORATION AND ELECTRIC LIGHTING.

Gas Company Protest against Unfair Municipal Trading.

In the "JOURNAL" a fortnight ago, reference was made to a proposal before the Harrogate Corporation to discontinue the use of gas and substitute electricity for the public lighting. The subject was dwelt upon at the annual meeting of the Gas Company by the Chairman (Mr. F. Barber), who showed a determination not to allow the change to be made without making a protest on behalf of the Company, not only as suppliers of gas but as large ratepayers, against the introduction of a competitive system of illumination by the municipal authority. At the meeting of the Lighting Committee of the Corporation on the 28th ult., a letter was read from the Secretary and General Manager of the Company (Mr. Harry Wilkinson) inquiring whether the Corporation would be prepared to receive from the Company an offer and terms for supplying gas and lighting and maintaining the whole of the public lamps in the borough; and the Committee resolved that their Chairman should have an interview with Mr. Wilkinson and report. It appears, from a long letter by Mr. Barber in the "Harrogate Herald" for last Wednesday, that the interview took place in his presence, at the Company's offices, on the 3rd inst.; and this is his account of it: "The Corporation representatives informed us that they had nothing to say, but had come to the interview to hear what the Company had to put forward; the Chairman saying that the letter from the Company's Manager had reached him when he was just on the point of putting the Electrical Engineer's scheme to the vote. I complained of the entire neglect of the courtesies due to the most ordinary business relations, and pointed out that, in view of the importance of the Company as a large ratepayer, and its obligations to supply gas for public lighting, and its long-continued connection with that public service, some intimation of the proposed change should have been given to the Company, and an opportunity extended to it to put in a tender for the public lighting by gas, which had never, in the opinion of the Company, been done in the most efficient and economical manner by the Corporation. On behalf of the Company, I offered, if the Electrical Department were prepared to do the same, to submit under seal to the whole Council of the Corporation an inclusive tender for the lighting of the whole of the borough by gas, or for lighting such part of it as was now so lighted. The Chairman of the Lighting Committee at once said that this could not be, as they had already had before them the details of the Electrical Engineer's scheme and cost. Nevertheless, I said that the Company would be prepared to stand or fall on any basis of fair competition between them and the Electricity Department, and said that if the Company could be furnished with the illuminating value and number of lamps proposed to be substituted for the present gas-lamps by the Electricity Department, we should be prepared to give an inclusive tender for supplying the same light by gas. To my surprise, the Chairman of the Lighting Committee said he could not give us such particulars, though I pointed out that it was impossible without them to give a tender on the same lines as the Electricity Department. The only gracious concession made to the Gas Company was that the Lighting Department would postpone the carrying out of the Electrical Engineer's scheme until the 4th of April, so that in the meantime the Company might have an opportunity of considering and submitting a proposal."

In another part of his letter, Mr. Barber explains the circumstances. He says in 1897 the Corporation, by authority of a Provisional Order, set up electricity works, which are outside the borough, and therefore no contribution is made to the rates in respect of the assessment for that part of their undertaking. The Gas Company pay in local rates a fraction under 2d. for every 1000 cubic feet of gas sold by them. This is mainly due to the high rates within the borough, which must enormously increase within the next few years. Without regard to the extra cost to the Lighting Department, a considerable length of the streets has since the institution of the electricity supply been lighted by electricity. The Electricity Department have offered special discounts to such of their customers as would use electricity to the exclusion of gas; thereby penalizing the consumer of electricity whose requirements could not be met without such use. Mr. Barber points out that the change proposed to be made in public lighting is one which may have very serious consequences to the ratepayers. If the question were open to discussion at a public inquiry by the Local Government Board on an application to borrow the money necessary for the cost of converting gas-lamps into electric lamps, there is little doubt, he says, that the increase in the cost of lighting by electricity would be shown to be so great that the Board would refuse the loan, as they have refused a similar loan elsewhere on this ground. He thinks this may be the reason why the Corporation propose to charge the cost of such conversion directly to the rates, spreading it over a number of years, instead of applying in the ordinary course for a loan to cover it. If the cost of public lighting will be considerably increased by the proposed change, the ratepayers will only have themselves to blame if they do not, before allowing it to pass, urge their representatives to obtain authentic information on the subject from other towns in which similar changes have been attempted and thoroughly investigated. He adds, in a postscript, that it would be interesting to find the case where the electric and gas undertakings being both in the hands of the corporation, or both in the hands of private companies, electricity has been adopted for the general lighting of the streets in preference to incandescent gas.

PRICE OF GAS IN NEW YORK.

Effect of the Eighty-Cent Law.

The report for the year ended Dec. 31 which was presented at the recent annual meeting of the Consolidated Gas Company of New York contains the following remarks on the decision of the Courts which fixed the price of gas in the city at 80 c. per 1000 cubic feet.

A comparison of the average sales of gas per meter in use in 1909, with gas at 80 c., with the average annual sales per meter in 1905, when gas was at $1, shows that there was no increase in the average sales per meter. In other words, the additional sales of gas in 1909 over 1905 were due entirely to the installation of additional meters, as the percentage of increase in the number in use and the percentage of increase in sales were identical. Such increase in the business as the Company have realized during the past four years has required not only an additional investment in manufacturing plant, but also in mains, services, meters, and appliances, and has added almost rateably not only to the cost of manufacture but to the cost of distribution, including repairs to the additional distributing system, additional expenses for collecting, and other items of operating cost, together with additional taxes on the additional property and earnings. The comparison of the sales per meter also establishes the fact that consumers have received the full benefit of the reduction in the price of gas, and that the Company have failed to realize the advantage which it was alleged they would realize, in the more liberal use of gas at the lower price. The opinion was expressed by experts several years ago that in New York City the gas sales per capita had reached the point of saturation. This was equivalent to saying that the sales per meter had reached that point. Experience during the four years mentioned would seem to confirm this opinion, and, furthermore, to establish the fact that a large percentage of the Company's future growth will be due to increase of population, which, in turn, must be attended by a proportionate increase of investment in gas manufacturing and distributing plant and operating expenses. On Jan. 25, 1909, the date of the last annual report, the Supreme Court of the United States had made a decision in the so-called 80-cent gas suit, upholding the contention of the Company on several important points, but deciding that the Act could not at that time be considered confiscatory. It was, however, held that, as it was possible that practical experience of the effect of the Act by actual operation under it might establish the fact that the Company could not obtain a fair return on the value of the gas property, the Company should have an opportunity of again presenting their case to the Court. The decree based on this decision was not, however, entered until Feb. 13, 1909, and the Company have therefore had an experience of less than the necessary twelve months under its operation. In accordance with the decision of the United States Supreme Court, there has been refunded to consumers during the year $10,417,121, involving the preparation and auditing of upwards of 1,360,000 vouchers, which necessitated the employment of over 750 men. This stupendous undertaking is now practically completed.

St. Mary Church Gas-Works.—Mr. F. Chalmers, the Manager of the St. Mary Church Gas-Works, has reported to the Torquay Town Council that during 1909 there was an increase of nearly 3,000,000 cubic feet in the quantity of gas manufactured at the works. In 1908, the amount made was 34,914,000 cubic feet, and in 1909 37,480,000 feet. The number of consumers at the end of the year was 1223, an increase of 82; while the cookers in use increased from 621 to 735.

Richmond and the Standard Burner Bill.—At the last monthly meeting of the Richmond Town Council, the General Purposes Committee reported that Messrs. Cooper and Sons, Parliamentary Agents for the Richmond Gas Company, had given a formal undertaking that, subject to the approval of Parliament, and in consideration of the abstention from opposition to the Gas Companies (Standard Burner) Bill, by the Corporation of Richmond, the following clause should be inserted in the Bill in Committee of the Second House: "Nothing in this Act contained shall, unless otherwise agreed between the Mayor, aldermen, and burgesses of the borough of Richmond (Surrey) and the Corporation of Richmond Gas Company, apply to or affect the borough of Richmond, in the county of Surrey." The Committee had accepted this undertaking.

Gas Supply to Cakemore.—At Old Hill, last Tuesday, Mr. Raymond Asquith held an inquiry, on behalf of the Board of Trade, into an application made by the Rowley Regis and Blackheath Gas Company for a Provisional Order to enable them to include the parish of Cakemore within their limits of supply for lighting purposes. Mr. H. Gibbon Pritchard, who supported the application on behalf of the Company, explained that objections were formally lodged to their proposals on behalf of the Rowley Regis and Halesowen District Councils, the Worcestershire County Council, the Great Western Railway Company, and the Dudley and Stourbridge Electric Traction Company. Provisions had been made in the Order which were satisfactory to four of the objectors; and the only opposition offered to the application now was from the Halesowen Rural Council. The chief grounds of opposition by the authority were that an application was before the Worcestershire County Council to obtain urban powers; and if this was sanctioned, the Rural Council would be vested with the lighting powers. The application of the Halesowen Council for urban powers had, however, been refused by the County Council.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held their annual statutory meeting on Thursday. In the report of the Engineer it was stated that the increase in the output of gas since May 15 last amounted to over 92 million cubic feet. The Committee dealing with the reorganization of the staff reported that over a hundred formal applications had been received for the post of Treasurer, and it was remitted to a Sub-Committee to prepare a short leet for the consideration of the full Committee. The Engineer reported that he had investigated, as far as circumstances permitted, the cause of public lamps failing to illuminate during frosty weather, and had come to the conclusion that the primary cause was the accumulation of hoar frost within the interior of the service-pipes which pass up the centre of the lamp-columns. It was not found difficult to render the lamp immediately efficient by pouring a small quantity of hydrocarbon spirit down the service-pipe. The secondary cause was brought about by the internal corrosion on the gas-pipe being liberated, due to the freezing of the pipe and the contraction of its parts, and the accumulated dust falling to the bottom of the upright pipe. Judge Pennell moved a remit to the Works Committee to consider and report as to whether the memorandum by the Clerk embodied in the minute of that Committee of the 14th ult. was in compliance with the Standing Orders of the Commissioners, and, if need be, to recommend such amendment of the Standing Orders as might seem fit. The memorandum, it will be remembered, was upon the subject of the appointment of a Committee to advise with the Engineer in the matter of the sale of sulphate of ammonia. After discussion, the motion was defeated by 13 votes to 3. Judge Douglas gave notice of motion to the effect that the Commissioners go back to their previous practice, and leave the sales of sulphate of ammonia and coke in the hands of Mr. Herring.

In the Glasgow Corporation on Thursday, Mr. M. W. Montgomery moved approval of the minutes by the Gas Committee, in which it was recommended that the Corporation should acquire the undertaking of the Baillieston Gas Company, Limited, at the price of £10,000. He explained that the Baillieston Gas Company were petitioners against the Glasgow Consolidation Order, and that it was in the course of discussion as to the best way to settle their differences that the question of purchase emerged. If the proposal had been the purchase of the Baillieston Gas-Works as a single item standing by itself, he would not have advocated it; but as it had a variety of considerations, and a great many associations and consequences to the future of the gas undertaking, he felt that the step now proposed was in the best interest of the Corporation and the Gas Committee. Bailie Guest moved that the subject be sent back to the Gas Committee for further consideration. The proposal was, he said, to pay £10,000 to enable them to supply gas to Baillieston—a right they had had for many years. Bailie Wallace said they were all aware that the moment the gas-works were bought they would be immediately scrapped, and the £10,000 would be thrown away. Mr. John Macfarlane said that the Baillieston Gas Company had created a good business, and they offered the goodwill of it at a very small cost. Mr. Montgomery replied that the works were perfectly equipped and in very good condition. The Committee did not intend to scrap them, excepting the retorts and purifiers, which would not be necessary. They were going to utilize the major portion of the capital which had been expended. By 38 votes to 26, the subject was sent back to the Committee.

The Corporation of Dunfermline have contracted for 15,000 tons of coal for the forthcoming year, at a lower rate than the prices being paid in the current year.

In the Inverkeithing Town Council last night, a letter from the Secretary of the Inverkeithing Gaslight Company was read, in which it was intimated that the Company were proposing to increase their share capital from £1100 to £4200, and that they were giving shareholders the first offer, in proportion to their holdings. The Town Clerk stated that the Corporation held fifty shares in the Company, and that under the proposed arrangement they would be entitled to a further hundred £1 shares. The Council agreed to refuse the offer of the Company.

Gas supply is keeping abreast of the gigantic strides which are being taken in the development of the Fife coalfield. Within the past few years new gas-works have been erected in Kelty and Kennoway; while extensions have been made to the gas-works at Cowdenbeath, Burntisland, and other places. The new gas-works at Cardenden, which were formally opened on Monday, are another step in the direction of progress. Mr. W. Brown, the Manager, has certainly got works which it ought to be a pleasure to run. The district is rapidly growing; and it is anticipated that in a very few years the annual output of gas will be over 20 million cubic feet. It is interesting to note that men of such outstanding business capacity as Mr. R. A. Muir, the Chairman of the Company, after much consideration, deliberately adopted coal gas as the lighting medium for the district, in preference to electricity or any other illuminant.

In the Wishaw Town Council on Monday, Provost Thomson took exception to the part of the minutes of the Gas Committee which dealt with the amount written off for depreciation, and moved that it be taken back for further consideration. It was agreed, he said, at a previous meeting, that the Gas Manager should go over the whole concern, and make a fair valuation, with the view of ascertaining what the real amount of depreciation on the works should be. The Committee had fixed the sum of £300 without obtaining that report. Bailie Bell, the Convener of the Gas Committee, explained that the amount had been fixed on reports from other burghs. The Town Clerk considered that as the Manager had been instructed to prepare a statement as to the percentage, there would be no harm in waiting until this had been submitted. Mr. Nimmo said the matter had been very fully gone into by the Committee, and, on a comparison with other burghs, the sum fixed was a liberal amount to allow. They had, therefore, sufficient

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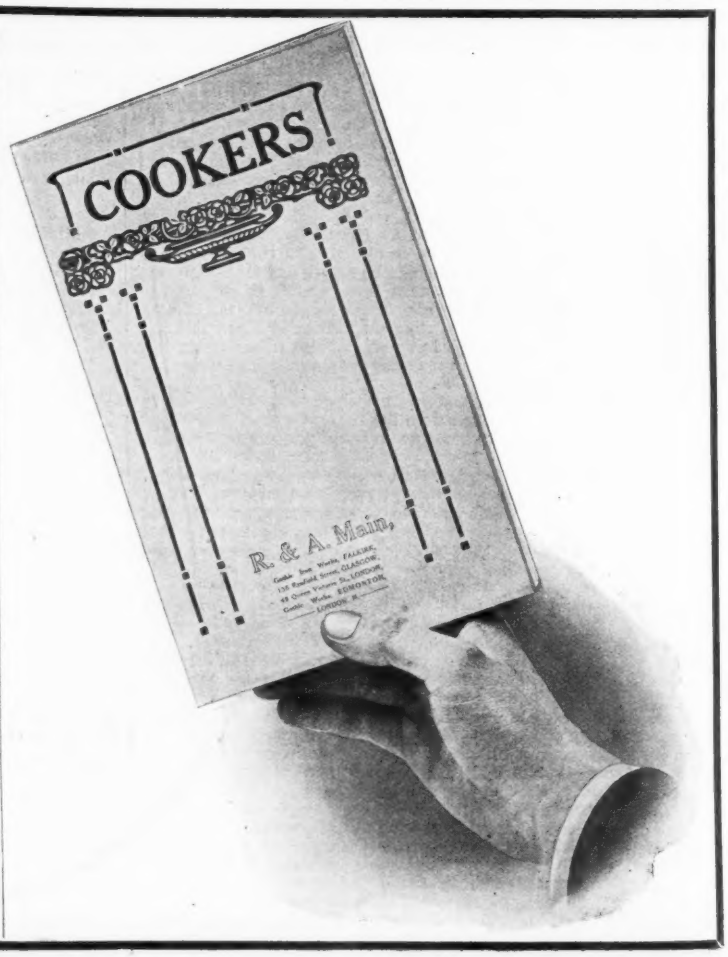

information to enable them to come to a decision; and he moved that the minute be adopted. This was agreed to by six votes to five.

In the Arbroath Town Council this week, it was reported that the valuation of the gas-works for income-tax purposes had been again increased, and it was remitted to the Town Clerk and the Manager to meet the Surveyor of Taxes with the view of having the valuation reduced.

In the Lerwick Town Council last week, Mr. Ratter brought up the subject of the laying of pipes by the Gas Company, and said he thought the Company should not be allowed to dig up the streets, as at present, without permission. The Burgh Surveyor suggested that the Company should be required to prepare a scale plan of every pipe which they proposed to lay. This was agreed to, and power was given to the Surveyor to allow the work to be gone on with if satisfied.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 19.

Sulphate of Ammonia.

During the week the market has continued buoyant, and, although the pace has been somewhat slower, a further increase in values has taken place. Further direct orders from consumers abroad, coupled with greatly improved demand for home consumption, have brought about keen competition for all available supplies, and the closing quotations are £12 7s. 6d. per ton f.o.b. Hull, £12 10s. per ton f.o.b. Liverpool, and £12 12s. 6d. per ton f.o.b. Leith. For equal monthly quantities July-December f.o.b. Leith, makers have now advanced their prices from £11 17s. 6d. to £12 per ton; but so far buyers refuse to follow them, preferring to take their chance later on.

Nitrate of Soda.

There continues to be a good inquiry for this article, and holders now ask 9s. 10½d. per cwt. for ordinary quality, and 10s. for refined, on spot.

LONDON, *March* 21.

Tar Products.

The markets for tar products have been very firm indeed during the past week. Pitch remains steady, and prices are well maintained, though there does not appear to be any actual advance in values. Creosote remains steady; and the majority of makers still consider an improvement will take place directly the heavy make is finished. In certain parts of England, this article is undoubtedly scarce. Benzol 90 per cent. is very firm indeed, and the prices are improving all round for both prompt and forward delivery, though it is reported that the Germans are selling in Paris at low prices. Fifty-ninety per cent. benzol is in good demand owing to the scarcity of toluol. For the latter article, there are inquiries to the end of the present year; but at present makers are not at all anxious to sell, as the great demand for solvent naphtha is bound to have an impression on this article. Solvent naphtha is quite firm, and in London and Manchester is very scarce. In London, some very good prices have been paid; and in Manchester it is reported that there is a difficulty in supplying the demand—as much as 1s. 6d. having been paid for special qualities. Crude carbolic acid is quiet. Continental consumers decline to offer more than 11½d. to 1s. per gallon on the east coast. Crystals are very neglected. Refined naphthalene is unchanged; but salts are fetching good figures. Tar maintains its price.

The average values during the week were: Tar, 15s. 9d. to 19s. 9d. *ex* works. Pitch, London, 31s. 6d.; east coast, 31s. to 31s. 6d.; west coast, 30s. to 31s. f.a.s. Mersey ports, and 30s. to 31s. others. Benzol, 90 per cent., casks included, London, 8d.; North, 7¼d. to 7⅜d.; 50-90 per cent., casks included, London and North, 8¼d. to 8½d. Toluol, casks included, London, 10¼d.; North, 9⅜d. Crude naphtha, in bulk, London, 4d. to 4½d.; North, 4d. to 4¼d.; solvent naphtha, casks included, London, 1s. 3¼d. to 1s. 4½d.; North, 1s. 2⅝d. to 1s. 3½d.; heavy naphtha, casks included, London, 11⅜d. to 1s. 0¼d.; North, 10⅜d. to 11⅜d. Creosote, in bulk, London, 2⅜d. to 2⅝d.; North, 2¼d. to 2½d. Heavy oils, in bulk, 2⅛d. Carbolic acid, 60 per cent., casks included, east and west coasts, 11½d. Refined naphthalene, £4 10s. to £8 10s.; salts, 45s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market continues very firm, though buying has not been so heavy. The actual Beckton price for prompt delivery is £12 8s. 9d. to £12 10s. 6d. Outside makes on Beckton terms are £12 2s. 6d. In Hull, £12 3s. 9d. to £12 5s. is quoted; in Liverpool, £12 6s. 3d.; in Leith, £12 8s. 9d. to £12 10s.; and in Middlesbrough, £12 3s. 9d.

New Joint Stock Companies.—The Standard Oxygen Light and Power Company, Limited, has been registered with a capital of £25,000, in £1 shares, to take over as a going concern the interest of B. P. Maisel and the rights of a business of gas, electric, and general engineers, manufacturers of oxygen and other light and power machinery, &c. The Kern Syndicate, Limited, has been formed with a capital of £10,000 in £1 shares (9500 "A" and 500 "B"), to carry on the business of manufacturers, distillers, and refiners of, and dealers in, crude and refined oils, sulphate of ammonia, and bye-products of coal, shale, oil, petroleum, &c.

Ottoman Gas Company, Limited.—At the meeting of the Company to-day (Tuesday), the Directors will report that the gas-rental for the half year ended Dec. 31 amounted to £19,593, compared with £18,383, for the corresponding half of 1908; and that the net profit is £5266, against £5058. The amount standing at the credit of the profit and loss account is £14,659, out of which the Directors have transferred £4000 to the reserve fund (increasing it to £20,000); and they recommend the payment of a dividend at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the rate of 8 per cent. per annum on the ordinary shares, tax free—leaving a balance of £7765.

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COAL TRADE REPORTS.

Northern Coal Trade.

There is a stronger inquiry in the coal trade; and, as usual before a general holiday, the shipments are fuller to allow stocks to be kept. In the steam coal trade, best Northumbrians are quoted from 11s. 4½d. per ton f.o.b. for prompt delivery, with a higher price for delivery over the season; and second-class steams are from 10s. to 10s. 4d. Steam smalls are more in request, and are quoted from 6s. to 7s. In the gas coal trade, the demand from the southern companies has now fallen off, as is usual at this season; but the exports are larger. Durham gas coals are now quoted from 10s. to 11s. per ton f.o.b. for the usual kinds, and up to 11s. 6d. for "Wear" specials—the better classes being firm. Sales have been made over the year—on the basis of about 10s. 4d. per ton for second-class Durhams, and 11s. to 11s. 3d. for bests. As to definite contracts, the St. Petersburg tenders for 85,000 tons are in close negotiation, and are likely to result in the allotment to the collieries that have for some time done a large part of this trade. Another contract (for Holland) is in the market for some 3300 tons for Baarne. Coke is steady; but gas coke seems now a little easier. Good gas coke is quoted at about 14s. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Trade remains brisk, outputs moving off very well. The foreign trade is particularly satisfactory; buyers being disposed to enter into contracts to cover the year. Prices are firm. These are now quoted at: Ell, 9s. 9d. to 10s. 6d. per ton f.o.b. Glasgow; splint, 10s. 9d. to 11s.; and steam, 9s. 6d. to 9s. 9d. The shipments for the week amounted to 309 988 tons—an increase of 36,748 tons upon the previous week, and of 42,816 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,779,236 tons—an increase of 459,811 tons upon the corresponding period.

Quality of the Gas at Pwllheli.—The following is taken from last Wednesday's issue of the "Liverpool Daily Post": During the last few nights, the inhabitants of Pwllheli have been in a state of irritation owing to the poor illuminating quality of the gas supply, which is a source of general complaint. Trade has had to be carried on in the various business establishments by the aid of lamps, &c.; and at the Post Office the clerks at the counter had to resort to candles. On Monday night, a protest meeting was held by the Ratepayers' Association; but as they had no authority over the Gas Company, a resolution was passed pledging the Council their support to insert a penalty clause in an agreement which is about to be entered into between the Company and the Council. Several present expressed their willingness to resort to the old tallow candles in the event of the Company refusing to accept the Council's terms.

Plymouth and the Standard Burner Bill.

By the failure of the Town Council to pass the statutory resolution by the necessary majority, the Plymouth Corporation are removed from the list of municipal opponents of the Standard Burner Bills. The meeting was held yesterday week; and the resolution authorizing the opposition was moved by the Mayor (Alderman J. Yeo), who expressed amazement that the gas companies should have proposed a change which meant a reduction in the lighting and heating power of the gas, and said it seemed to be exactly on a par with a proposal of a coal owner to a large number of contracts on hand to alter the standard of weighing from 20 cwt. to the ton to 18½ cwt., without any reduction in the price. Mr. Jacobs thought the Mayor had been misinformed as to the effect of the proposal. All that was intended was to change the standard burner used for testing purposes, not to interfere with the quality of the gas. Mr. Edgcumbe said the quality of the gas supplied would depend upon the test-burner used; and he did not think the Company were making the change in the interest of the consumers. Mr. Munday believed that opposition to the Bill would not be in the interests of the consumers. On the face of it, it was surely to the advantage of everyone that the quality of the gas should be accurately tested. The interests of the consumers were bound up with those of the Company, because the consumers were indirectly shareholders, and anything financially injurious to the Company would affect their customers. If the terrible things apprehended by the Mayor were likely to occur in Plymouth from the adoption of the standard burner, why had not those towns in which it was used revolted? He considered the opposition to the Bill needless, because even if one admitted, which he did not, that the burner was not a success, the Bill empowered a corporation at any time to appeal to the Board of Trade against its continued use. On a vote being taken after further discussion, 26 were in favour of opposing the Bill and 8 against; while 9 (including the Mayor) were neutral. The Town Clerk explained that, though the resolution was carried, it would not be effective, as an absolute majority of the members of the Council had not voted in its favour.

On Monday afternoon of last week, an outbreak of fire occurred in the smoke-room at Easton Park, the residence of the Marquis of Graham; but fortunately it was extinguished before much damage had been done. The cause of the accident was the fusing of an electric wire; and when the fire was discovered, it had obtained a good hold of the structure surrounding the place where the wire fused.

For the £10,000 of new "B" stock of the Eastbourne Gas Company recently advertised in these columns, tenders were received for above £50,000. The average price of the whole of the tenders was £130 10s. per £100 of stock, which would have given the investor a return of £4 16s. 6d. per cent. The £10,000 allotted yielded, including premiums, £13,834, at an average of £138 6s. 8d. per £100 of stock—yielding to the investor a return of £4 10s. 4d. per cent.

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Davis Gas-Stove Company, Limited.

The report which was submitted at the tenth annual general meeting of the Davis Gas-Stove Company, Limited (which was held at the Cannon Street Hotel last Thursday), stated that the net profits for the year to Dec. 31 amounted to £13,602, to which must be added the amount brought forward, £4095, giving a total divisible profit of £17,697. Deducting from this the dividend on the 5½ per cent. preference shares for the year, amounting to £3244, and the interim dividend on the ordinary shares at the rate of 5 per cent. per annum for the half year ending June 30, 1909, amounting to £1478, in all £4722, there remained a balance of £12,975. It was proposed to distribute £2943 in paying a dividend on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, for the half year to Dec. 31, making 7½ per cent. for the year; to add £5149 to the reserve account, making it £24,000; and, after providing £503 for the proportion of the profits payable to the Directors, there would remain £4380 to carry forward. In moving the adoption of the report, Mr. H. J. Davis, the Chairman, expressed the hope that the balance-sheet had afforded as much gratification to shareholders as it had done to the Board. For 1908, the dividend paid on the ordinary shares was 5 per cent.; while for the past twelve months it would be 7½ per cent.—with a bigger carry forward, and the addition of £5149 to the reserve. The amount of profit brought into the balance-sheet from the profit and loss account for the year under consideration was £13,602, as against £8254 for 1908—being a net improvement of £5348. At previous meetings he had explained the position in regard to the two foundries which were on hand and could not then be disposed of, and had made it quite clear that in all probability sooner or later a loss would have to be made upon them, and that such loss would be written off from the reserve account. He was glad to say they had now been successful in letting upon lease almost the whole of these two freehold properties; and what had been disposed of was bringing in a yearly rental of close upon £800. This had enabled the Board to revalue them on a reasonable basis, having regard to their earning power and selling possibilities; and they had written off any excess over and above such valuation standing upon the books heretofore. The gross profits for 1908 were £44,284, as against £52,122 for the past year. This was an increase of nearly £8000, against which there was naturally an increase under the head of trade expenses, but only to the extent of £2944. The motion for the adoption of the report was seconded by Mr. Harold N. Davis, who referred to the progress made during the last three years—since the time of the transfer from the two old foundries to Luton. Apart from the obvious advantage to be gained from this centralization of the business, he said, the chief reason for building these works was that they might be in a position to increase their trade, which was impossible under the old conditions. The growth of business had exceeded their most sanguine expectations; and it had already been necessary, not only to add to all the departments, but also to create new ones. For some considerable time past, they had been actively engaged in gas-heating research work and the scientific side of manufacturing; and this department was becoming so important that they had built and equipped a new suite of laboratories and experimental workshops for these operations. That the time occupied and expense incurred in this direction were fully justified, was proved by the enormous improvements they had been able to make in all their standard goods, as well as by the inventions they had brought out, which had been of great commercial value. The Directors looked forward to the future with every confidence; for the Company were in a position to meet any competition. The report was adopted; the retiring Director (Mr. C. S. Barber) was re-elected; and a hearty vote of thanks was passed to the Chairman, Directors, and staff—this being acknowledged by Mr. Cyril G. Davis.

Improvements at Tiverton Gas-Works.

A report by Mr. Clark Jeffery, the Gas Engineer and Manager of the Tiverton Corporation, recommending a number of improvements at the gas-works, was considered by the Town Council yesterday week. The recommendations included the re-erection of the second section of the retort-benches to complete the installation on the regenerative system, at an estimated cost of £1450; oxide and purifier sheds, £420; underground tar and liquor tank, £220; and a new 12-inch main, £360. Mr. Jeffery stated that 300 tons of coal had been saved since September owing to the use of the present retorts on the regenerative system, and there had been a much larger sale of coke. Consequent on leakage in the present underground tank, about 30,000 gallons of tar and liquor were wasted each year. If a new tank, having a capacity of about 10,000 gallons, were constructed, the Council could with advantage commence the manufacture of sulphate of ammonia. The Lighting Committee recommended that application be made to the Local Government Board for a loan of £3000 to cover the cost of the proposed works and of new mains during the ensuing three years. Alderman Heywood complained of the expenditure on the works, which he considered excessive. Alderman J. Thorne, the Chairman of the Committee, said the original loan of £22,000 would be paid off in seven years; and they would then probably owe about £12,000 on the gas undertaking. He hoped that in a few years the gas-works would be in a position to contribute to the reduction of the rates. Mr. Amory pointed out that the expenses of the loan would be only £180 a year, and said they had already saved £500 by the adoption of the new retorts. The recommendations were agreed to.

The British Mannesmann Tube Company point out, with reference to the paragraph in our issue of the 15th inst. as to the Lichfield Gas Company, that the 3½ miles of main therein mentioned will be composed entirely of Mannesmann weldless steel spigot-and-faucet tubes.

The tenders for the issue of 2019 "B" shares of £10 each in the Bournemouth Gas and Water Company were opened last Thursday. The minimum price of issue was £15 per share; and the whole of the shares were allotted at an average price of £15 19s. 2d. per share—the applications amounting to over three times the number offered.

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Sales of Gas and Water Shares.

The sale conducted by Messrs A. & W. Richards at the Mart, Tokenhouse Yard, E.C., last Tuesday included two new issues of capital. A parcel of 600 "B" shares (£5) in the Romford Gas Company, Limited, ranking for a standard dividend of 7 per cent., subject to the sliding-scale (the existing "B" shares carrying 10 per cent.), were readily purchased at from £10 5s. to £10 7s. 6d. each; yielding the buyer £4 17s. 6d. per cent. Some 4 per cent. debenture bonds of the same Company were sold at par. The other new issue was by the Wandsworth and Putney Gas Company, who offered some 3 per cent. debenture stock, at a reserve price below par; and it fetched from £78 to £78 10s. per £100. Some ordinary stock of the Gaslight and Coke Company, sold by order of executors, realized from £104 to £104 10s. per £100; £900 of consolidated stock of the Mitcham and Wimbledon Gas Company fetched £120 and £121 per £100; and £370 consolidated stock in the Sevenoaks Water Company, now carrying the maximum dividend of 10 per cent., with occasional payments on account of back-dividends, sold for £256 per £100. At a recent sale at Great Budworth, seven 4 per cent. preference shares in the Northwich Gas Company fetched £11 5s. each.

Tar-Spraying of Roads.—The Devon County Council decided at their meeting last week that a sum not exceeding £1000 should be spent during the present financial year on further experiments in the tar-spraying of main roads. The reports of the surveyors on last year's experiments were, on the whole, favourable. One of the surveyors said that tarring paid for doing, especially upon a good, sound surface. It saved the road from wear, and prevented water soaking into the foundation. Mr. Hurrell, the Chairman of the Main Roads Committee, said that they began experimenting rather too late in the year, and the tar came up again. Where there was heavy motor traffic, the roads would have to be tarred several times before they could get a sound surface. Dr. Mackenzie stated that in the Tiverton district tar-spraying had been a marked success. It had tended to the life of the road, as well as to the comfort of the people living by the roadsides and the benefit of the users of the road. Mr. Willcocks recommended the Committee to experiment in tar binding, which he said made an excellent road.

Proposed Additional Water Scheme for Nuneaton.—At the last monthly meeting of the Nuneaton Town Council, the Water-Works Committee reported having considered a proposal to acquire a site at Griff for the purpose of a new pumping-station, and had received a report from Mr. W. Whitaker, F.R.S., whom they had consulted in regard to the matter, confirming the opinion of their Engineer as to the suitability of the site. The Committee were of opinion that, having regard to the rapid growth of the population and the corresponding increase in the consumption of water, the new works should be put in hand as early as possible; and they recommended that application should be made to the Local Government Board for sanction to a loan of £5000 for the purpose of sinking the shaft. Alderman Johnson said the matter had been before the Committee for some months. With the permission of Mr. F. A. Newdegate, M.P., a borehole had been put down in order to test the proposed supply, which had been favourably reported upon by Dr. Bostock Hill. The Committee considered the site was the most suitable one in the borough. The report was adopted.

APPLICATIONS FOR LETTERS PATENT.

5596.—Morgan, J. H., "Clips for securing pipes." March 7.
5623.—Lamont, D., "Gas globes and chimneys." March 7.
5634.—Dean, H., "Boxes for mantles." March 7.
5718.—Lamkin, A. E., and Hunter, L., "Gas-burners." March 7.
5735.—Docking, A., "Gas-pendants." March 8.
5776.—Hibberd, C. E., "Gas-meters." March 8.
5798.—Cowper-Coles, S. O., "Smokeless fuel." March 8.
5817.—Hancock, E. E., and Arnold, C. F., "Gas-generators." March 8.
5824-5-6.—Glover, T., "Water-heaters." March 8.
5840.—Clark, H. N., "Cock for controlling the supply of gas from the main to the meter." March 8.
5844.—Freisinger, A., "Incandescent gas-lamps." March 8.
5845.—Hibberd, F. C., "Cocks or valves." March 8.
5891.—Thorp, T., F., and H. T., "Proportional valve for the mixture of two or more fluids." March 9.
5912.—Parkinson Stove Company, Ltd., and Cheshire, W., "Street-lamps." March 9.
5945.—Dawson, Sir A. T., and Buckham, G. T., "Fluid-pressure valves." March 9.
5946.—Blau, H., "Inverted lamps." March 9.
5950.—Hanwell, H. W., "Gas-pendants." March 9.
5951.—Hanwell, H. W., "Gas-fittings having an adjustable drop." March 9.
5967.—Kerrill, H., Conyngham, F. E. S. (Marchioness Conyngham), and Moleyns, F. R. W. E. de, "Producing gas from petrol or other volatile spirit." March 10.
5974.—Biggart, A. S., "Charging and discharging gas-retorts." March 10.
6008.—Knorr, L., "Heating apparatus for gasholders." March 10.
6067.—West, J., and Glover, S., "Vertical retort discharging apparatus." March 10.
6071.—Milbourne, R. J., "Fastening india-rubber pads to the covers of gas-purifiers." March 10.
6073.—Potter, W. G., "Rotary pumps and meters." March 11.
6136.—France, A. G., and Cunningham, C., "Gas-stoves." March 11.
6138.—France, A. G., "Joints for pipes." March 11.
6154.—Delage, M., and Woog, P., "Electrically lighting gas-burners." March 11.
6177.—Rowntree, B. S., and Fryer, F. G., "Removing solid impurities from gas. March 11.

Gas Cookers.

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(Incorporating
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BIRMINGHAM & LONDON
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SPRING HILL. W.C.

Unsatisfactory Electric Lighting.—Complaint is again being made by the Redruth District Council as to the unsatisfactory lighting of the town, which is carried out under contract by an Electric Lighting Company. At the last meeting of the Council, Mr. Hooper remarked that a portion of the town had been in total darkness on recent nights. Mr. Rodda said something had apparently gone wrong; and in the efforts of the Company to find the cause, matters had got worse. The lighting of the town was abominable; and the lamps could not be depended upon for a single night. In reply to a question as to the Council's remedy, the Clerk said they could sue the Company for damages if the lamps continued to be unlighted, and after 48 hours' notice. Mr. Bawden remarked that one part of the town had been in darkness for three weeks; the village of St. Day, with oil-lamps, was better lighted than Redruth. It was suggested that the Company should be written to again; but a majority of the members thought this useless, and it was decided that the penalty clause of the contract should be enforced.

New Water-Works for Lincoln.—The new works for supplying Lincoln with water are being rapidly pushed forward. All four boreholes at Elkersley are completed, together with the approach road, and six miles of rising main have been laid and tested. The ironwork for the reservoir at Bracebridge is in position, and the concrete is being moulded on it. This reservoir is circular in form, and measures about 260 feet across; the outside wall being vertical on the outer face but battered inside from a thickness of nearly 7 feet at the bottom to 3 feet at the top. The roof is of ferro-concrete, supported upon numerous columns, and is practically flat, only a slight rise being given in the middle for drainage purposes. The floor has a fall of 6 inches from the wall to the centre, where the water will reach a depth of 20 feet. Upon arriving at Lincoln, the water will be delivered into a tank mounted upon a tower. The overflow from the tank will pass along 3½ miles of main, ranging from 21 to 18 inches in diameter, and will be delivered into a 10,000-gallon tank mounted upon a tower at Bracebridge for supplying the local demand.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SUPERINTENDENT OF PUBLIC LIGHTING. Calcutta Corporation. Applications by May 3.
REPRESENTATIVE FOR INDIA. Tylor and Co., York Road, N.
REPRESENTATIVE. Voelker Lighting Corporation.
TRAVELLER. No. 5208.
METER MAKERS AND REPAIRERS. Portsea Island Gaslight Company.

Situations Wanted.

MANAGER, SUPERINTENDENT, &c. No. 5204.
SUPERINTENDENT OF DISTRIBUTION, &c. No. 5206.

Plant, &c. (Second Hand), for Sale.

AIR GAS PLANT. Charrington and Co., Mile End.

Gas-Works for Disposal.

LAINDON GAS-WORKS. By Auction. April 12.

Stocks and Shares.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY. April 5.
HORLEY GAS COMPANY.
LOWESTOFT WATER AND GAS COMPANY. April 5.
SEVENOAKS WATER COMPANY. April 2.
TENDRING HUNDRED WATER COMPANY. April 6.
WORTHING GAS COMPANY. April 5.

TENDERS FOR

Coal and Cannel.

ASHFORD (KENT) GAS DEPARTMENT. Tenders by April 4.
EDINBURGH AND LEITH GAS DEPARTMENT. Tenders by March 24.
NEWPORT (FIFE) GAS DEPARTMENT. Tenders by April 1.
STOCKPORT GAS DEPARTMENT. Tenders by April 6.
STOURBRIDGE GAS DEPARTMENT. Tenders by April 12.

Condensers, &c.

LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by April 2.
MIDDLETON CORPORATION. Tenders by March 30.

Conveyor.

PETERBOROUGH GAS COMPANY. Tenders by April 8.

Fire-Clay Goods.

COLWYN BAY AND COLWYN URBAN DISTRICT COUNCIL. Tenders by April 9.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by March 24.
LOUGHBOROUGH GAS DEPARTMENT.

General Stores—

(Bolts and Nuts, Oils and Paints, Lime, Compo. Pipe, Iron and Steel, Tools, Buckets, Gloves, Ironmongery, Brass Fittings, &c., Cocks, Taps, Valves, Castings, &c.)
COLWYN BAY AND COLWYN URBAN DISTRICT COUNCIL. Tenders by April 9.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by March 24.
ROCHDALE GAS DEPARTMENT. Tenders by March 30.

Governors (Retort-House).

LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by April 2.

Incandescent Goods.

COLWYN BAY AND COLWYN URBAN DISTRICT COUNCIL. Tenders by April 9.

Meters.

COLWYN BAY AND COLWYN URBAN DISTRICT COUNCIL. Tenders by April 9.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by March 24.

Oil for Gas Manufacture.

EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by March 24.

Oxide (Spent).

EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by March 24.

Pipes.

COLWYN BAY AND COLWYN URBAN DISTRICT COUNCIL. Tenders by April 9.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by March 24.
RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by April 5.
ROCHDALE GAS DEPARTMENT. Tenders by March 30.

Retorts, &c.

LOUGHBOROUGH GAS DEPARTMENT.

Tar Extractor.

LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by April 2.

Tar and Liquor.

DEVONPORT GAS DEPARTMENT. Tenders by March 29.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 786.

Issue	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Oct. 14	5	Alliance & Dublin Ord.	86–88	..	5 13 8
310,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
200,000	5	Oct. 28	7†	Bombay, Ltd.	6⅞–6⅞	+⅛	5 5 8
40,000	5	,,	7†	Do. New, £4 paid	5–5¼	+⅛	5 6 8
50,000	10	Feb. 25	15	Bourne-mouth Gas and Water Pref. 6 p.c.	29–30	..	5 0 0
311,810	10	,,	7		10½–10¾	..	4 3 7
75,000	10	,,	6		15–15¼	..	3 17 5
380,000	Stk.	,,	12½	Brentford Consolidated	250–253	..	4 18 10
300,000	,,	,,	9⅜	Do. New	187–189	..	5 0 6
50,000	,,	Aug. 12	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	,,	Dec. 29	4	Do. 4 p.c. Deb.	101–103	..	3 17 8
220,000	Stk.	Mar. 16	11	Brighton & Hove Orig.	213–216*	+½	5 1 10
246,320	,,	,,	8	Do. A Ord. Stk.	150–153*	..	5 4 7
462,000	23	Oct. 14	16⅔†	British	44½–45½	..	4 13 6
109,000	Stk.	Feb. 25	6	Bromley, A 5 p.c.	116–118	..	5 1 8
165,700	,,	,,	4½	Do. B 3½ p.c.	87–89	..	5 1 2
82,278	,,	,,	5½	Do. C 5 p.c.	103–105	..	5 4 9
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	87–89	..	3 18 8
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	14⅜–15¼	..	4 11 10
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	4–5	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	6–7	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	49–50	+½	6 0 0
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	86–88	..	5 2 3
157,150	Stk.	Feb. 25	5	Chester 5 p.c. Ord.	105–108	..	4 12 7
1,513,280	Stk.	Feb. 25	5⅛	Commercial 4 p.c. Stk.	105–108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	103–105	..	4 15 3
475,000	,,	Dec. 29	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800 000	Stk.	Dec. 10	5	Continental Union, Ltd.	97–99	..	5 1 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–140	..	5 0 0
492,270	Stk.	—	5	Derby Con. Stk.	121–123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
148,995	,,	Oct. 2	5	East Hull 5 p.c. Ord.	98–100	..	5 0 0
486,090	10	Jan. 27	12	European, Ltd.	24½–25⅜	..	4 17 0
354,060	10	,,	12	Do. £7 10s. paid.	18⅝–19	..	4 14 9
15,141,545	Stk.	Feb. 10	4⅝	Gas light and Coke 4 p.c. Ord.	103–104	–¼	4 9 8
2,600,000	,,	,,	3⅛	3½ p.c. max.	88–90	..	3 17 9
3,799,735	,,	,,	4	4 p.c. Con. Pref.	103–105	..	3 16 2
4,193,975	,,	Dec. 29	3	3 p.c. Con. Deb.	81–83	..	3 12 3
258,740	Stk.	Mar. 16	5	Hastings & St. L. 3½ p.c.	93–95*	+½	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	117–119*	+1½	5 9 3
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17⅜–18	..	6 2 3
131,000	Stk.	Mar. 16	7½	Ilford A and C	142–144*	+½	4 17 3
65,780	,,	,,	5⅜	Do. B	105–103*	..	5 1 10
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	100–102	..	3 18 5
4,940,000	Stk.	Nov. 11	8	Imperial Continental	177–179	+1	4 9 5
1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	93–95	+1	3 13 8
195,242	Stk.	Mar. 16	6	Lea Bridge Ord. 5 p.c.	120–122*	+3	4 18 4
561,000	Stk.	Feb. 25	10	Liverpool United A.	222–224	..	4 9 3
718,100	,,	,,	7	Do. B	163½–165½	..	4 4 7
306,083	,,	Dec. 29	4	Do. Deb. Stk.	103–105	..	3 16 2
75,000	5	Nov. 26	6	Malta & Mediterranean.	4⅛–5	..	6 0 0
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	99–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12⅜–13¼	..	5 5 8
1,775,892	Stk.	Feb. 25	4⅛	Newc'tle & G'tesh'd Con	104–105	..	4 3 4
529,435	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	91–93	..	3 15 3
55,940	10	Feb. 25	7	North Middlesex 7 p.c.	12¾–13¼	..	5 5 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	139–141	..	5 13 6
60,000	5	Sep. 10	8	Ottoman, Ltd.	6⅜–6⅝	..	6 5 6
31,800	53	Feb. 25	13	Portsea Island A.	134–136	..	5 1 0
60,000	50	,,	13	Do. B.	126–128	..	5 1 7
100,000	50	,,	12	Do. C.	119–121	..	4 19 2
114,800	50	,,	10	Do. D and E.	100–102	..	4 18 0
398,490	5	Oct. 28	7	Primitiva Ord.	7⅞–7⅞	..	4 8 11
796,980	5	Jan. 27	5	Do. 5 p.c. Pref.	5⅝–5⅞	..	4 7 8
488,903	100	Dec. 1	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
1,000,000	10	Oct. 14	8	River Plate Ord.	17⅞–18⅛	..	4 7 8
312,650	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
250,000	10	Sep. 29	9†	San Paulo, Ltd.	15⅝–16⅜	..	5 10 9
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅞–12⅛	..	4 18 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50–51	..	4 18 0
135,000	Stk.	Sep. 10	10	Sheffield A	233–235	..	4 5 1
209,984	,,	,,	10	Do. B	233–235	..	4 5 1
523,500	,,	,,	10	Do. C	233–235	..	4 5 1
70,000	10	Oct. 14	10	South African	12⅛–12⅜	..	7 16 11
6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	120–122	..	4 9 7
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	81–83	–1	3 12 3
209,823	Stk.	Mar. 16	8	South Shields Con. Stk.	157–158*	..	5 1 3
605,000	Stk.	Feb. 25	5⅝	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	119–121	..	4 2 8
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	121–123	..	4 1 4
502,310	Stk.	Nov. 11	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Feb. 10	6⅝	Tottenham A 5 p.c. and B 3½ p.c.	133–135	..	5 1 9
453,940	,,	,,	5⅝		112–114	..	4 14 4
149,470	,,	Dec. 29	4	Edmonton 4 p.c. Deb.	99–101	+1	3 19 3
182,380	10	Dec. 29	8	Tuscan, Ltd.	9¼–9⅜	..	8 4 2
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 0
236,476	Stk.	Feb. 25	5	Tynemouth, 5 p c max.	112–114	..	4 7 9
255,636	Stk.	Feb. 25	6⅝	Wands-worth B 3½ p.c.	139–141	..	4 14 0
79,416	,,	Dec. 29	3	3 p.c. Deb. Stk.	74–76	..	3 18 11

Prices marked * are "Ex div." † Next dividend will be at this rate.

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In consequence of the EASTER HOLIDAYS, all Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than the FIRST POST ON SATURDAY.

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See Advertisement on p. 838.
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See Illustrated Advertisement, Feb. 1, p. 277.

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Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

GAS TAR wanted,
Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

GEO. NEWTON, Limited,
Wires: "Automatic, Manchester."
40 YEARS' REPUTATION.
WET, DRY, ORDINARY and PREPAYMENT, STATION METERS, &c.
Late of Oldham—Note *new* Address:—
39, RIVER STREET, HULME, MANCHESTER.

LITLE'S PATENT INVERTED GAS-BURNER.
THERMOSTATIC regulation of Air and Gas prevents Flashbacks and Carbonization, and insures highest Candle-Power efficiency.
Thomas J. Litle, Junr., Inventor, Bush Lane House, Cannon Street, London.

APPLICATIONS FOR APPOINTMENTS.

DO you appreciate how much success depends on well-considered and lucid presentment of your qualifications? I make a Specialty of the Preparation of Applications, and am continually receiving complimentary letters from clients. Write now for Particulars.
Herbert Greatorex, Hackney, Matlock.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Specialty of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

WANTED by Advertiser (Age 26)—of good inventive ability, who has had Six Years Experience in a large London Gas Company; also good Commercial Training—position as MANAGER, SUPERINTENDENT, or any POSITION of RESPONSIBILITY. Good Prospects more Important than Commencing Salary. Excellent References (London preferred).
Address No. 5204, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SUPERINTENDENT of Distribution (Age 30) of Good Address, just returned from an Appointment with a progressive Gas Company abroad, seeks ENGAGEMENT. Thorough Practical Knowledge of Gas Supply, well Informed on most Modern Methods of Meeting Competition and obtaining New and Permanent Business. Good Commercial Training. Energetic. Excellent Testimonials.
Address No. 5206, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Representative with Technical and Commercial Training and a thorough knowledge of Water Works Fittings and Appliances, to TRAVEL in India and the East.
Apply, stating Age, Experience, and Terms required, to J. Tylor and Sons, Limited, Belle Isle, York Road, London, N.

THOROUGHLY up to-date and pushing TRAVELLER required by a well-known Firm for London and Suburbs. Only those with a sound Connection among Gas Companies and Ironmongers need Apply. Salary no object to the right man.
Apply, by letter, to No. 5208, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by the Voelker Lighting Corporation, Limited, a REPRESENTATIVE, having Connection among Corporations, Gas Companies, and the Incandescent Trade generally, in the Southern and Eastern Counties.
Apply, by letter only (which will be treated as confidential), marked, "Representative," giving full Particulars as to Present and Past Employment, and Salary required, to Albert Works, Garratt Lane, Wandsworth, S.W.

PORTSEA ISLAND GASLIGHT COMPANY.

RUDMORE WORKS.

WANTED—Two First Class and Com- petent GAS-METER MAKERS and REPAIRERS. Must have had Experience with both Ordinary and Automatic Dry GAS-METERS. Age, about 30 Years.
Apply, in writing only, giving References, and stating Wages, to
J. D. Ashworth, M.I.Mech.E.,
Engineer and General Manager.
Gas-Works, Flathouse, Portsmouth.

CORPORATION OF CALCUTTA.

1. THE Corporation of Calcutta are prepared to receive APPLICATIONS for the Post of SUPERINTENDENT OF PUBLIC LIGHTING of the City of Calcutta.

2. Calcutta has a street mileage of about 270 Miles, and is Lighted by means of about 9000 Incandescent Gas-Lamps; the Gas being supplied by a Public Company, with the exception of a few of the outlying Streets and Roads, where there are no Gas-Mains, which are at present lighted by Oil-Lamps, but the Area lighted by Gas is being extended every Year. It is in contemplation to light some of the principal thoroughfares by means of Electric Lamps.

3. Candidates must have Experience of the Management and Control of Lighting Departments in some other City or Town, and must be capable of advising the Corporation as regards the formation of a Municipal Lighting Department and also regarding the selection of Burners, Mantles, &c. Candidates must also be experienced in Photometric Work, and the Corporation has a thoroughly up-to-date and well-equipped Photometric Laboratory. Candidates must be capable of accurately Testing Pressures in, and outside of, the Laboratory, and of determining the discharging capacity of Burner Nipples, as this will be the measure of the amount of Gas to be paid for in the lighting contract about to be entered into. The Corporation have proper and efficient Apparatus for doing this. Candidates should not exceed 45 Years of Age and should furnish a Certificate of Age and also a Certificate of Physical Fitness. The appointment will be for Five Years, with option of renewal, and the Corporation will pay First-Class Passage from England to Calcutta. The appointment will be terminable on Three Months' notice by either side. In case the Corporation gives the notice, a First-Class Passage to England will be provided if required for that purpose. In the event of the selected Candidate giving notice during the currency of his Agreement, he will be required to refund the amount of his First-Class Passage.

4. One Month's leave on full pay may be granted every Year, and longer leave out of India at intervals. The pay of the Post is Rs. 500 per Month, rising to Rs. 750 per month by equal annual increments; but the Corporation are prepared to give the maximum pay of the post—*viz.*, Rs. 750 per month—to a well-qualified and otherwise specially suitable Candidate. The exchange value of the Rupee may be taken as equivalent to One Shilling and Four pence.

5. Applications, stating Experience, Age, and Qualifications, and accompanied by *Copies* of Testimonials, should be addressed to the Secretary, Calcutta Corporation (*not by name*), Calcutta, India, and should reach him on or before the 3rd of May, 1910.

P. N. Mookerjee,
Secretary to the Corporation.

Municipal Office,
March 3, 1910.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
John Radcliffe, Chemical Engineer, East Barnet.

FOR SALE—A Quantity of Hurdle GRIDS, 3 ft. 6 in. high, in good Condition. Cheap for immediate Sale.
Apply to Firth Blakeley, Sons, and Co., Ltd., Thornhill, Dewsbury.

FOR SALE—One 150-Burner Complete Plant made by the National Air Gas Company, Limited. Nearly new and in Good Order.
Can be seen, by Appointment, at Messrs. Charrington and Co., Ltd., Anchor Brewery, Mile End, E.

GASHOLDERS - Splendid 45 feet dia- meter and New STEEL TANK, fixed Complete to Plan and Specification; also 14 feet and 16 feet Diameter GASHOLDERS, with STEEL TANKS. Can be seen temporarily erected. Re-erected Cheap for immediate Sale.
Firth Blakeleys, Thornhill, Dewsbury.

THE Corporation of Middleton invite TENDERS for the Erection of a New CONDENSER at the Gas-Works.

Further Particulars and Form of Tender, which will contain a Fair Wages Clause, may be obtained on Application to Mr. C. F. Broadhead, Gas Engineer, Gas-Works, Middleton.

Tenders, addressed to the Chairman of the Gas Committee, endorsed "Condenser," must be delivered at my Office not later than March 30, 1910.

The Corporation do not bind themselves to accept the lowest or any Tender.

Frederick Entwistle,
Town Clerk.

Town Clerk's Office,
March 14, 1910.

BOROUGH OF ROCHDALE.
(Gas Department.)

THE Gas and Electricity Committee of the above Corporation invite TENDERS for the Supply and Delivery of such Quantities of the undermentioned GOODS as they may require during a period of Twelve Months from April 1, 1910.

1—Cast-Iron Main Pipes and Specials.
2—Wrought-Iron Tubes and Fittings.
3—Lime for Gas Purification Purposes.
4—Engine and Cylinder Oils.
5—Bar and Sheet Iron.
6—Steel Charging Shovels.
7—Galvanized Iron Buckets (7 lbs., 12 in.)
8—Stokers Gloves.

Forms of Tender for Items 1, 2, and 4 may be had on Application to Mr. T. Banbury Ball, the Manager, at the Gas-Works, Dane Street, from whom any further Information may be obtained.

Tenders, properly endorsed and addressed to the Chairman of the Gas and Electricity Committee, must be sent in to me not later than noon on Wednesday, March 30, 1910.

By order,
Wm. Henry Hickson,
Town Clerk.

Town Hall, Rochdale,
March 18, 1910.

TENDERS FOR COAL.

THE Town Council of Newport, Fife (Gas Department), invite TENDERS for the Supply of CANNEL, GAS COAL, Single, Double, and Treble NUTS, per Ton delivered at their Railway Siding, for Twelve Months as from May 15, 1910.

Tenders, marked "Tender for Coal," to be addressed to John Scrimgeour, Esq., Town Clerk, not later than Friday, April 1.

The Council do not bind themselves to accept the lowest or any Tender.

John F. Black,
Manager.

Gas-Works, Newport,
March 14, 1910.

URBAN DISTRICT COUNCIL OF COLWYN BAY AND COLWYN.

GENERAL GAS STORES.

TENDERS are invited for the Supply of the following STORES and MATERIALS, in such Quantities as may be required in the Gas Department of the above Council, for the Year ending the 31st of March, 1911—viz:

Fire-Clay Goods, Lime, &c.
Iron Tubes and Fittings.
Lead and Compo.
Iron and Steel.
Oils and Paints.
Brass Fittings and Sundries.
Slot Fittings.
Dry Meters.
Main Taps.
Steam Valves.
Castings.
Incandescent Lighting Goods.
Ironmongery.

Form of Tender and any Information may be had from the undersigned, to whom sealed Tenders, endorsed "Tenders for Gas Stores," addressed to the Council Offices, Colwyn Bay, must be delivered not later than Saturday, the 9th of April next.

The Tender of any person who, personally or through an Agent, Canvasses any of the Officers or Members of the Council will be rejected.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
James Amphlett,
Clerk to the Council.

Council Offices, Colwyn Bay,
March 17, 1910.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

GENERAL STORES.

THE Commissioners invite Tenders for the Supply of GENERAL STORES for the Year ending the 15th of May 1911, comprising, among others, the following:—

Cast-Iron Pipes and Connections.
Iron Castings.
Tubes and Fittings.
Merchant Iron and Steel.
Bolts, Nuts, and Rivets.
Tools, Implements, and Ironmongery.
Brass Cock Fittings and Meters.
Timber, Yarn, Waste, &c.
Oils and Paints.
Gas Oil, Fireclay Materials.
Causeway Repairs.
Removal of Spent Oxide of Iron.

The Contractors will be required to Guarantee that in the execution of their Contracts they pay the Standard Rate of Wages or such Rates as are generally recognized as fair in their Localities.

Schedules and Forms of Tender and Samples may be seen, and further Information obtained upon Application to Mr. W. R. Herring, the Commissioners' Engineer and General Manager, at his Office, Calton Hill, Edinburgh.

Offers must be lodged not later than Ten o'clock on Thursday forenoon, the 24th day of March, 1910, in Sealed Envelope, addressed to the undersigned, and marked "Tender for ———," as the case may be.

The Commissioners are not to be bound to accept the lowest or any Tender.

James M'G. Jack,
Clerk.

25, Waterloo Place, Edinburgh,
March 14, 1910.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

GAS COAL.

THE Commissioners are prepared to re- ceive TENDERS for the Supply of GAS COAL, yielding a satisfactory quality of Coke, for Delivery at their Granton Works over a period of about Twelve Months from June 10 next.

The monthly requirements during the period approximate the following percentages; but the Commissioners do not guarantee these percentages:—

July	4 per cent.	January	15 per cent.
August	5 " "	February	10 " "
September	6 " "	March	8 " "
October	10 " "	April	6 " "
November	12 " "	May	5 " "
December	15 " "	June	4 " "

The Contractors must Guarantee that in the execution of their Contracts they Pay the Standard Rates of Wages, or such Rate as is generally recognized in their Localities.

Further Particulars with Schedule and Form of Tender, may be obtained on Application to Mr. W. R. Herring, the Engineer and General Manager of the Commissioners at his Office, Calton Hill, Edinburgh.

The Tenders to be lodged not later than Ten o'clock on Thursday forenoon, the 24th day of March, 1910, in Sealed Envelope, addressed to the undersigned, and marked "Tender for Coal."

The Commissioners are not to be bound to accept the lowest or any Tender.

James M'G. Jack,
Clerk.

25, Waterloo Place, Edinburgh,
March 14, 1910.

LOUGHBOROUGH CORPORATION.
(Gas Department.)

RENEWAL OF RETORTS.

TENDERS are invited by the Gas Committee for the RENEWAL of RETORTS.

Further Particulars to be obtained from
Edward Onions,
Engineer and Manager.

Gas-Works, Loughborough,
March 16, 1910.

COUNTY BOROUGH OF DEVONPORT.
(Gas Department.)

THE Gas Committee invite Tenders for the Purchase of the Surplus COAL-GAS TAR and WATER-GAS TAR produced at their Works during the Year ending March 31, 1911.

Tenders to state Price per Ton for—
(*a*) Coal-Gas Tar,
(*b*) Water-Gas Tar,
at the Gas-Works, Devonport, and must be received by the undersigned on or before Tuesday, March 29, 1910.

William P. Tervet,
Engineer and Manager.

PETERBOROUGH GAS COMPANY.

THE Directors of the above Company invite TENDERS for a HOT COKE CONVEYOR.

Tenders, addressed to the Chairman of the Company, Gas-Works, Peterborough, and endorsed "Conveyor," to be delivered not later than the 8th of April, 1910.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars from
John Barton,
Secretary.

Gas-Works, Peterborough,
March 11, 1910.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TENDERS FOR PIPES.

TENDERS are invited for the Supply of 12-inch CAST-IRON GAS MAINS, in 12 feet Lengths.

Further Particulars may be obtained from the undersigned, by whom Tenders will be received until Tuesday, the 5th of April.

James Braddock,
Manager and Secretary.

Gas-Works, Radcliffe,
March 14, 1910.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(Gas Department.)

THE Gas Committee invite Tenders for the Supply of about 20,000 Tons of Good Screened GAS COAL, delivered on their Gas-Works.

Forms of Tender may be had on Application to the undersigned, and only Offers on our own Form will be considered.

Tenders, endorsed "Gas Coal," addressed to the Chairman of the Gas Committee, to be sent to me at the Gas-Works, Stourbridge, on or before Tuesday, April 12, 1910.

The Contract will contain a Fair Wages, &c., clause.

The lowest or any Tender not necessarily accepted.

By order of the Committee,
Charles H. Webb,
Engineer and Manager.

Gas-Works, Stourbridge,
March 18, 1910.

TO GAS PLANT MANUFACTURERS AND OTHERS.

THE Llandudno Urban District Council invite TENDERS for the Supply and Erection at their Gas-Works of the following PLANT—namely, RETORT-HOUSE GOVERNORS, TAR-EXTRACTOR, CONDENSER, and SUNDRY CONNECTIONS.

A Specification and Form of Tender may be obtained, and Plans be inspected, on Application to Mr. Shadbolt, the Gas Manager, and, if required, copies of the Plans may be had on payment of the sum of 10/- (Ten Shillings).

Tenders must be sent in to the undersigned not later than Saturday, the 2nd of April, endorsed "Gas-Works Extensions."

The Council do not undertake to accept the lowest or any Tender.

A. Conolly,
Clerk to the Council.

Town Hall, Llandudno,
March 18, 1910.

COUNTY BOROUGH OF STOCKPORT.
(Gas Department.)

THE Gas Committee are prepared to receive TENDERS for a Supply of CANNEL and COAL.

Forms of Tender, Specifications, and Conditions of Contract, together with any further Information, may be obtained from the Engineer, Mr. S. Meunier.

No Form of Tender other than that issued by the Committee will be considered.

Sealed Tenders, endorsed "Coal," must be addressed to the Chairman of the Gas Committee, Town Clerk's Office, Stockport, and must be sent in before Twelve o'clock Noon on Wednesday, April 6, 1910.

No Tender will be accepted without satisfactory proof that the Firm tendering pays the Trade Union Rate of Wages and observes the Trade Union Number of Hours as are usually paid and observed in the district where the Goods are made or produced.

The Committee reserve the right to accept for the whole or any portion of the quantity offered, but do not bind themselves to accept the lowest or any Tender.

By order,
Robert Hyde,
Town Clerk.

March 19, 1910.

ASHFORD, KENT, URBAN DISTRICT COUNCIL.
(Gas Department.)

THE above Council are prepared to receive TENDERS for the Supply of 6000 Tons of GAS COAL in accordance with the Conditions of Contract which can be obtained from the undersigned.

Sealed endorsed Tenders must be delivered to the Clerk to the Council, 11, Bank Street, Ashford, Kent, not later than Nine a.m. on April 4, 1910.

The lowest or any Tender not necessarily accepted.

H. R. Turner,
Engineer and Manager.

Gas-Works, Ashford,
Kent, March 21, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES,

AND

£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, April 5, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

NEW ISSUE OF £32,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, April 5, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
WORTHING GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £3473 CONSOLIDATED ORDINARY STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, April 5, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

In the High Court of Justice, Chancery Division,
Mr. Justice Joyce. 1909, L. No. 1586.

THE FREEHOLD GAS-WORKS
OF THE
LAINDON AND DISTRICT GASLIGHT, COKE, AND WATER COMPANY, LIMITED,

Situate about 23 miles from London, within a short distance of the Laindon Station on the London, Tilbury, and Southend Railway. The Works comprise: **Retort House** with Eight Retorts, Vertical Condenser, Cast-Iron Scrubber, Tar-Tank and Pump, Two Purifiers, with Lifting and Traversing Apparatus, **Gasholder, 400-Light Station Meter,** together with the Mains, Services, Meters, and Tools, the whole **to be sold** as a **Going Concern** and with **Possession on completion of the purchase.**

MR. WILLIAM RICHARDS, of the Firm of **MESSRS. A. & W. RICHARDS** (the person appointed by the said Judge), will SELL THE ABOVE BY AUCTION, at the Mart, London, E.C., on Tuesday, April 12th., at **One** o'clock, precisely in One Lot.

The Works may be viewed, and Particulars with Conditions of Sale obtained, of J. Montague Haslip, Esq., Solicitor, 6, Martin's Lane, Cannon Street, E.C.; of Harry Barker, Esq., Chartered Accountant, 6, Old Jewry, E.C., and of the Auctioneers, 18, Finsbury Circus, E.C.

HORLEY DISTRICT GAS COMPANY.

SALE BY TENDER OF £3000 ADDITIONAL "B" CAPITAL STOCK.

Minimum Price, Par.

In pursuance of the Horley District Gas Act, 1901,

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to OFFER FOR SALE, by TENDER, £3000 of the above Stock, to be paid up in full on or before the 30th day of April next, such Stock being a portion of the Additional Capital Authorized to be raised by Resolution passed at an Extraordinary General Meeting of the Proprietors held on the 12th day of September, 1901, under powers of the above mentioned Act.

Particulars and Conditions may be obtained on Application to the undersigned.

By order of the Board,
R. Seymour Tobey,
Secretary.

Offices: Station Road, Horley,
Surrey, March 2, 1910.

By Order of Executors, to close an Estate.

TENDRING HUNDRED WATER-WORKS COMPANY.

TWENTY £10 "A" SHARES;
DIVIDEND FOUR-AND-A-HALF PER CENT.

MESSRS. EDWIN FOX, BOUSFIELD, BARNETTS, and BODDELEY will include in their next STOCK and SHARE AUCTION, at the Mart, E.C., on Wednesday, April 6, at Two o'clock, the above Shares, in Lots.

Particulars at the Auctioneers' Office, 99, Gresham Street, London, E.C.

SEVENOAKS WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the Sevenoaks Water-Works Company, in pursuance of their Provisional Order of 1908, as confirmed by Act of Parliament, being desirous of increasing their Capital, have resolved to issue Three Hundred 4 PER CENT. PREFERENCE SHARES of TEN POUNDS each.

Tenders are hereby invited from the Public for the same at not less than par value.

The present issue of Capital is made to provide for the Extension of Mains and other works, and also for the Repayment of Sums over-expended on Capital Account.

The Company are paying the Maximum Dividend on their Stock and Ordinary Share Capital.

Tenders are to be addressed to the Company at their Offices, Oak Lane, Sevenoaks, on or before Saturday, the 2nd day of April, 1910, and endorsed "Tender for Shares."

The Shares are Payable as under—viz.:
£2 on Application,
£3 on Allotment,
and the Balance on the 1st day of July, 1910.

Where no Allotment is made, the Deposit will be returned in full.

Forms of Tender on Application at the Company's Offices.

By order of the Board,
Alfred Grainger,
Secretary.

Offices: Oak Lane, Sevenoaks,
March 9, 1910.

THE SECOND EDITION OF
GAS COMPANIES'
BOOK-KEEPING.
A Practical Treatise on the Keeping of Gas Companies' Accounts.
By
JOHN HENRY BREARLEY, and
BENJAMIN TAYLOR.
Price Net: Complete, Cloth Bound, 12s. 6d.; Morocco Gilt, 15s.
London:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

JOHN HALL & CO. OF STOURBRIDGE,
LIMITED,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

LUX'S
Gas Purifying Material
is now used in many Gas-Works throughout Scotland with gratifying success.
FRIEDRICH LUX
Ludwigshafen-am-Rhein
Sole Agent for Scotland:
DANIEL MACFIE
1, North Saint Andrew Street, EDINBURGH
Telegrams: "GASLUX, EDINBURGH"
Descriptive Pamphlet on Application.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE, LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

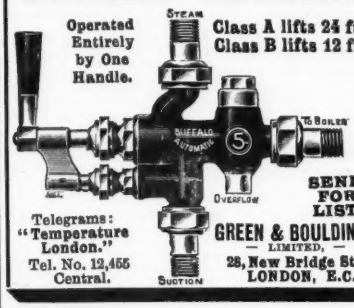
Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: E. C. BROWN & Co., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.
Please apply for Price, Analyses, and Report, to the
MIRFIELD COLLIERY COMPANY,
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

BRASS AND STEEL PINION WIRE
any lengths.
John Rigby & Sons, Ld.
Rawfolds Wire Mills, *CLECKHEATON.*
Head Office & Works:
Adelphi Wire Mills, *Salford, MANCHESTER.*
Also IRON and STEEL WIRE of all descriptions.

'BUFFALO' INJECTOR
Operated Entirely by One Handle.
Class A lifts 24 ft.
Class B lifts 12 ft.


SEND FOR LIST.
Telegrams: "Temperature London." Tel. No. 12,455 Central.
GREEN & BOULDING, LIMITED, 28, New Bridge St., LONDON, E.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

HEATHCOTE GAS COAL
from the
GRASSMOOR COLLIERIES,
CHESTERFIELD.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

THE WIGAN COAL & IRON CO., LIMTD.,

Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

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Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone: No. 200.
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Rheinische Chamotte-und Dinas-Werke, Cologne on Rhine.

Construction of

Entire Gas-Works & Coke Oven Plants,

Retort Furnaces,

Furnaces for Chamber Settings (*Patent*), New Coke Ovens (*Patent*),

With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.

ADDITIONAL REVENUE FOR GAS-WORKS.

COKE SELLING . . AT 11/6 A TON
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IN THE SAME TOWN.

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COALEXLD, LIMITED.
LANCASTER.

WATER SUPPLIES.

ARTESIAN BORED TUBE WELLS,
Norton's Patent "Abyssinian" Tube Wells.
Deep Well Pumps and Patent Air Lift Pumps.
LE GRAND & SUTCLIFF,
Artesian Well and Waterworks Engineers,
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AN EPOCH IN GAS MANUFACTURE.

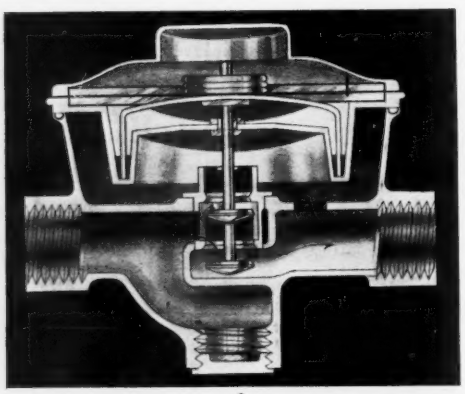
THE VERTICAL GAS RETORT SYNDICATE, LIMITED,
(DESSAU SYSTEM)
17, VICTORIA STREET, WESTMINSTER, S.W. (*See Full Page Advertisement, p. 1., Nov. 30.*)

Workmanship and Materials of the Highest Quality.

PECKETT'S LOCOMOTIVES.

Built to any Specification or Gauge.

PECKETT & SONS,
ATLAS LOCOMOTIVE WORKS, BRISTOL.



MERCURIAL PRESSURE GOVERNOR for fixing at Gas Meter. Inlet may be at 1 or 2.

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GAS GOVERNORS

Ensure a Steady Outlet Pressure and Improve the Lighting.

PEEBLES & CO., LTD.,
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The Outcome of a Practical Gas Engineer's Life Experience.

THE CENTENARY PETROL GAS TURBINE GENERATOR.

FOR
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FOR
Villages,
Mansions,
Farm Steadings,
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Railway Stations,
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Plants from 100 cub. ft. per hour up to 50,000 cub. ft. per hour for Gas Works.

THE CENTENARY GAS CO. (Dept. M.)
WILLIAM KEY, Engineer.

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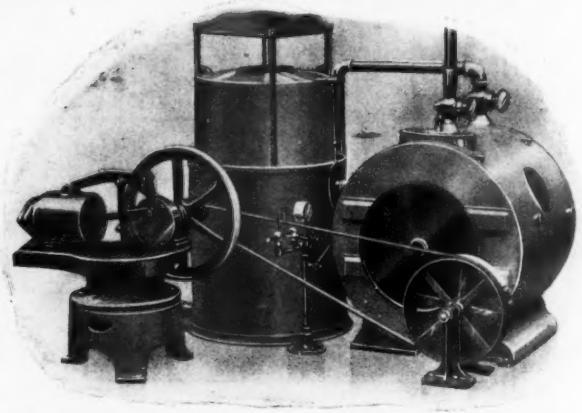


NON-EXPLOSIVE and ECONOMICAL.

GRAETZIN LIGHT

Important Improvements.

BURNERS.

1. **20-Candle Power more light** without increase in the consumption of gas.
2. **Patent Gas Adjuster**; cannot get out of order.
3. **Automatic Gas Regulator,** ensures a constant and unvarying pressure of 35 mm., guarantees a steady light, at the same time obviating waste of gas and blackening of the burner.
4. **Accurate Regulation of the Air Supply.**
5. Burners will be supplied either with Gas Adjuster or Automatic Gas Regulator.
6. The brass casing is heatproof, and, if occasionally cleaned with warm water, will not become discoloured.

LAMPS.

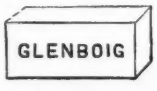
From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

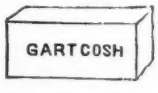
THE GLENBOIG UNION FIRE-CLAY CO., LTD.

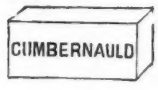
GLENBOIG FIRE-BRICKS AND GAS-RETORTS.

Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

TRADE MARKS.



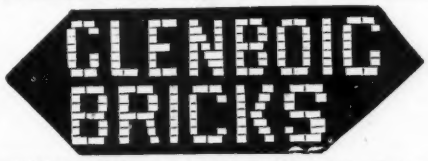




The Glenboig Trade Marks are imitated, and the Glenboig Name unfairly used by Makers of a lower Class of Goods, which, when sold under their own name, command much lower prices.
The Genuine Brand, Stamped on the Goods, is the only Reliable Guarantee to the Purchaser.

GAS-RETORTS, FIRE-BRICKS, BLOCKS, &c., &c.

The SPECIAL BRICKS used in the Construction of Gas Furnaces for Heating Retorts.



Works: GLENBOIG, LANARKSHIRE.
Offices: 48, West Regent St., Glasgow.

56 Prize Medals and Diplomas of Honour.
Highest Award wherever exhibited.

The GLENBOIG BRICKS, BLOCKS, AND RETORTS combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, LEADENHALL STREET,
LONDON, E.C., September 21st, 1909.

DEAR SIRS,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

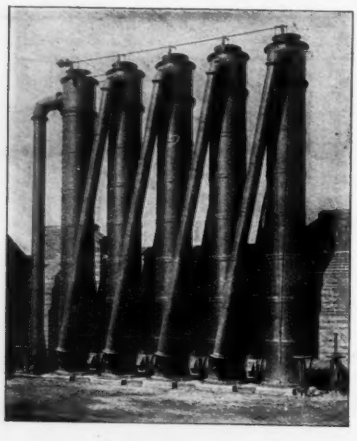
Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·70%
" " " 1050° C.	4·76%
" " Total	8·46%
Volume shrinkage at 100° C.	10·7 %
" " " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. to 3362° F.

(SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.



GASHOLDERS.
WITH GUIDE FRAMING OR COLUMNLESS.

LUTED PURIFIERS LUTELESS

WATER **Condensers** AIR

GAS PLANT OF EVERY DESCRIPTION
DESIGNED AND ERECTED.

C. & W. WALKER, LTD., MIDLAND IRON WORKS, DONNINGTON, SALOP. 110, CANNON STREET, LONDON, E.C.

Gas Engineers of the most important Works are high in their praises of the Fire-Clay Goods supplied by

MOBBERLEY & PERRY OF STOURBRIDGE.
LIMITED,

GAS-RETORTS A SPECIALITÉ.

S. CUTLER & SONS, MILLWALL, LONDON.
And at 39, Victoria St., Westminster, S.W.

GASHOLDERS & STEEL TANKS

Carburetted Water Gas Plant.

DESSAU VERTICAL RETORTS.

Messrs. S. CUTLER & SONS are Contractors to the Vertical Gas Retort Syndicate, Ltd., for all Constructional Steel Work, Operating Gears, Fittings, &c., &c.

The DESSAU System has been adopted at over 60 Gas-Works and up to the present date 5238 Retorts have been ordered.

WATER TUBE CONDENSERS. PURIFIERS.
OIL TANKS. ROOFS. GIRDERS.

Every Requirement for Gas-Works Supplied.

No. 252

GRAHAM, MORTON & CO.,

— LEEDS. —

RETORT BUILDERS ON THE

INCLINED, HORIZONTAL, OR VERTICAL

SYSTEM.

Contractors to the Vertical Gas Retort Syndicate, Ltd., for all BRICKWORK in the

DESSAU VERTICAL RETORT INSTALLATIONS.

See Certified Results of the first Installation on this System in England erected at The Ayres Quay Gas-Works, Sunderland.

Makers and Erectors of

COAL & COKE CONVEYING PLANTS

COMPLETE WITH

Elevators, Conveyors, Breakers, Bunkers, &c.

STEEL STRUCTURAL WORK. ROOFS, &c.

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LIMITED,

BIRMINGHAM, ENGLAND.

IMMEDIATE DELIVERY FROM STOCK.
UNBREAKABLE.
EASILY ERECTED. LIGHT FOR SHIPMENT.

Capacity, 9600 Galls. *Size, 16 × 12 × 8 ft. deep.*

PATENT PRESSED STEEL TANKS.

MADE FROM FLANGED PLATES 4 FT. SQUARE.
ANY CAPACITY IN MULTIPLES
OF 4 FT. LENGTH, WIDTH, OR DEPTH.

HUMPHREYS & GLASGOW'S CARBURETTED WATER-GAS PLANTS.
Aggregate capacity of Plants supplied, 231,600,000 cubic feet daily.

R. LAIDLAW & SON (EDINBURGH), LTD.

GAS METER MAKERS.

STATION METERS

IN

Ornamental Square & Round Cast-Iron Cases.

ALL SIZES.

Drawings, Specifications, and Prices on Application.

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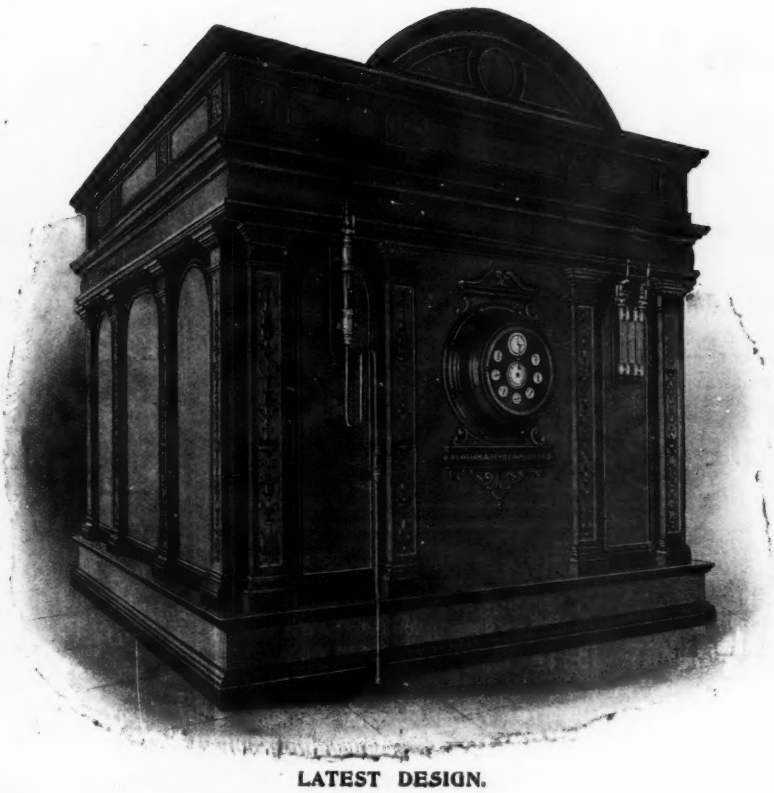
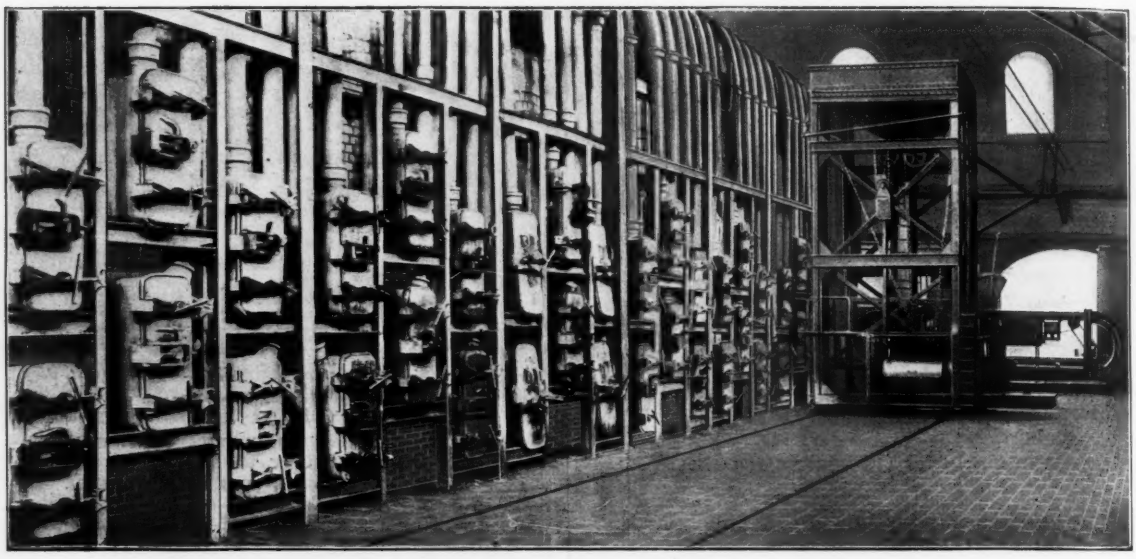
EDINBURGH,
AND
6, LITTLE BUSH LANE,
LONDON, E.C.



LATEST DESIGN.

GLOVER'S PATENT

NORWICH CHAMBER RETORT SETTINGS.



SPECIAL ADVANTAGES:—

21 CWT. CHARGES or larger if required.

GAS RESULTS, **13,600** cub. ft. of **14·5** c.p. gas per Ton of coal carbonized.

COKE, **GREY, DENSE,** and **MASSIVE,** suitable for many metallurgical purposes and for malting.

OPERATING COSTS considerably lowered owing to greatly reduced number of operations.

ADAPTABLE TO EXISTING REGENERATORS.

The work of **CHARGING AND DISCHARGING** these Chamber Retorts is performed by the **"D.B." STOKING MACHINES** with the same **SMOOTHNESS** and **RELIABILITY** that characterizes the working of the **"D.B. MACHINES"** with ordinary Retorts.

THE ONLY MACHINES THAT WILL COMPLETELY FILL CHAMBERS OR RETORTS.

Write for full Particulars to

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Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

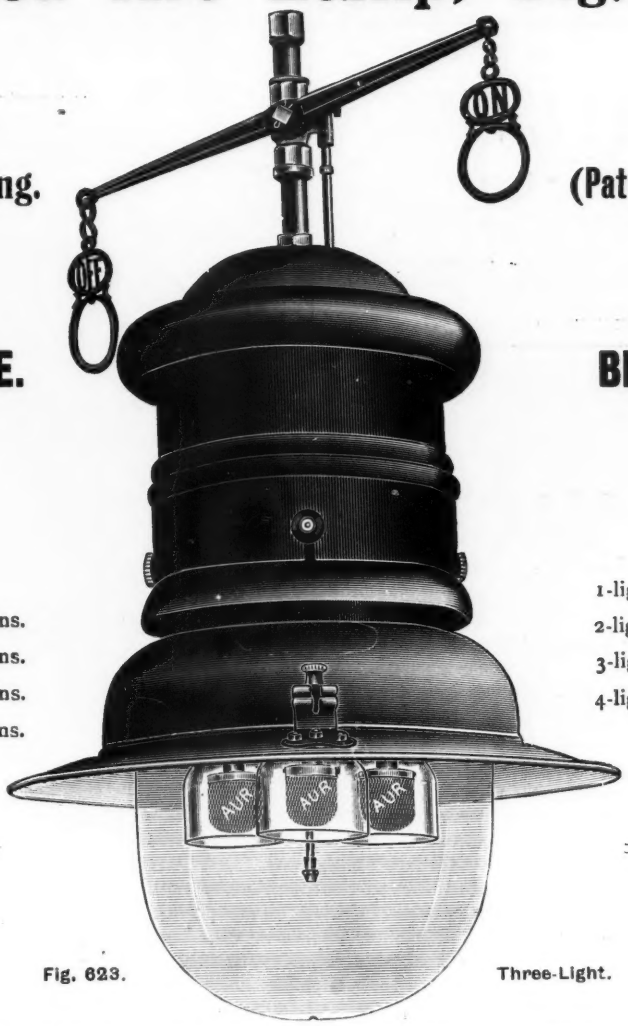

Fig. 623. Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.
3-light	12 feet	400	**52/6**	**6/-** extra.
4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

		1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra	each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra	"	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.
Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*

SPECIAL ROTARY METER.

For Coke Oven Gas.
For Blast Furnace Gas.
For FOUL GAS.

Particulars on application to—

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GAS COAL AND CANNEL.

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Gas, Steam, and other Fuel for Home and Export.

GAS COKE CONTRACTORS.

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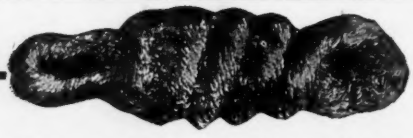

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Is sent out in Skeins all ready for use.
Every Skein of equal weight and length.
The Lead Wool Joint is built up evenly all the way through.
Lead Wool requires no melting and can be used in water without risk.

Lead Wool Joints are Twice as Strong as Cast Lead Joints and cost 33⅓ per cent. less.

THE LEAD WOOL CO., LTD., SNODLAND, KENT.
Telegrams: "STRENGTH, SNODLAND." Telephone 199 SNODLAND.

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THE GASHOLDERS AND OTHER OUTSIDE PLANT IT IS FALSE ECONOMY TO USE A CHEAP PAINT WHICH LOSES COLOUR AND DOES NOT PROTECT THE IRON FROM CHEMICAL FUMES.

"SHELL BRAND" (Pure) PAINTS

POSSESS ALL THE PROPERTIES WHICH CHEAP PAINTS LACK.

Prices and particulars on application.

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Possilpark, Glasgow.

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ENGINEERS,
HASLINGDEN, nr. MANCHESTER.

LIME & OXIDE ELEVATORS & CONVEYORS.
COAL AND COKE STORAGE PLANTS.
Coal and Coke Elevators and Conveyors.
STAMPED AND RIVETED STEEL ELEVATOR BUCKETS.
DETACHABLE CHAINS AND SPROCKET WHEELS.
HIGH-CLASS STEAM ENGINES. · BEAM PUMPING-ENGINES, &c.

DON'T BUY GAS METERS OR GOVERNORS

UNLESS THEY ARE MADE BY
MILNE'S
MILTON HOUSE WORKS EDINBURGH

GEO. K. HARRISON, LTD.

STOURBRIDGE

CONTRACTORS TO THE CHIEF GASWORKS IN THE BRITISH ISLES AND ABROAD.

FOR

MANUFACTURED FROM OUR CAREFULLY SELECTED AND WELL SEASONED STOCK OF OLD MINE FIRE CLAY.

RETORTS

EVERITT'S Patent

TAR-FOG EXTRACTOR
AND
NAPHTHALENE REMOVER.

SOLE MAKERS:

ROBERT DEMPSTER & SONS,
ROSE MOUNT IRON-WORKS, LTD.,
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DO YOU USE STEEL TUBES FOR CROSSING BRIDGES?

If you use them in such a position, where their durability is tried most severely, why not for your ordinary Mains and services? They are far cheaper and more reliable under all conditions if they are

Mannesmann Weldless Steel Tubes.

Hundreds of Gas and Water Authorities have already adopted them; why hesitate? If you have any doubts on any point connected with their use, write us, as we feel sure we can clear them up. A trial will be even more convincing.

THE

BRITISH MANNESMANN TUBE CO., LTD.,

Makers of Weldless Steel Spigot and Faucet, Screwed and Socketed, Flanged, &c., Tubes, Ascension Pipes, Lamp Posts, Drums, Cylinders, &c., &c.

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Agents for New South Wales, Queensland, and Victoria:
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— 2000 Workmen. —

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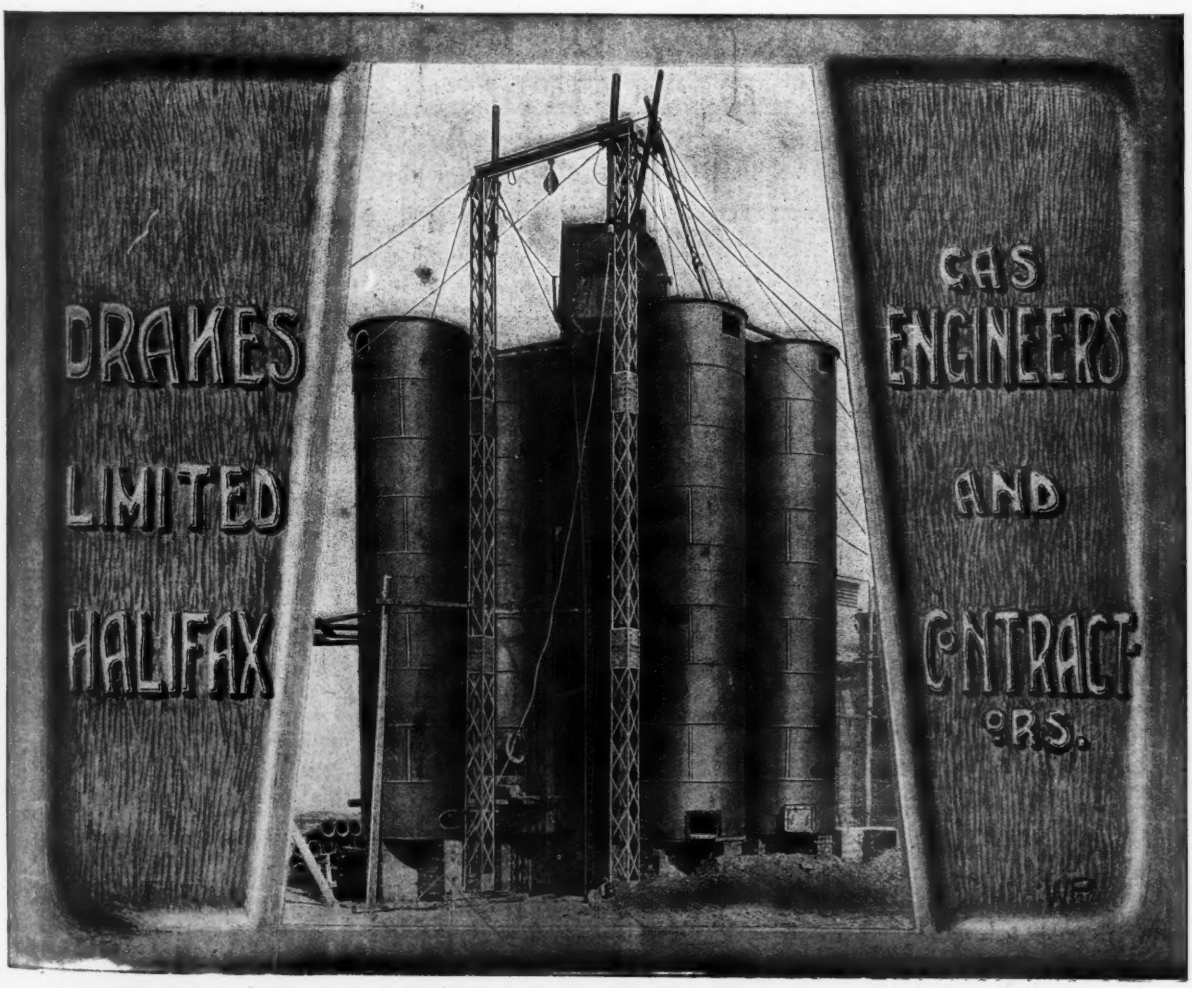
In point of efficiency, cost of production and results:

BEST FURNACES in the WORLD!



CONTINUOUS CARBONIZATION

IN

VERTICAL RETORTS

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GLOVER-WEST PATENTS.

Description and Particulars of Tests will be forwarded on request.

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COST OF LABOUR

REDUCED TO

2¾d. PER TON OF COAL CARBONIZED.

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No. 14,406 London (Central).

Engineers,

MILES PLATTING, MANCHESTER.

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